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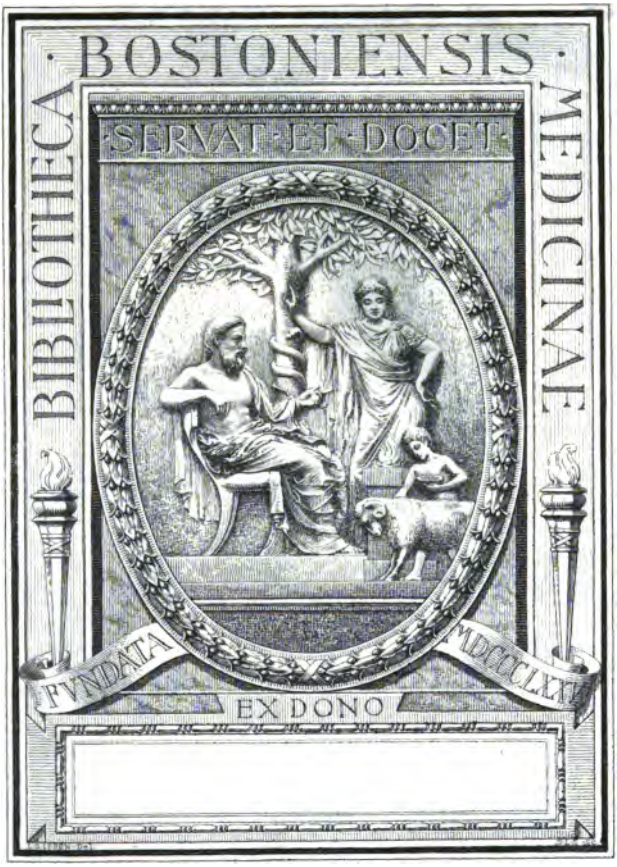
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MEDICAL REVIEW:

A MONTHLY JOURNAL

OF

THE MEDICAL SCIENCES.

EDITED BY

DOUGLAS STANLEY, M.D. EDIN., M.R.C.P.,

AND

LEONARD GAMGEE, F.R.C.S.

VOL. V. NEW SERIES.
VOL. LVII. OLD SERIES.

BIRMINGHAM:
PERCIVAL JONES LIMITED, 87-89, EDMUND STREET.
1905.

CATALOGUED
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BOSTON MEDICAL
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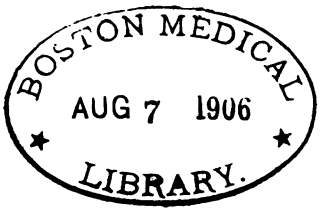

THE CURE OF CONSUMPTION.

(According to George Bodington and Henry MacCormac.)

By Charles Gaskell Higginson, M.A., L.R.C.P. (Lond.).

Since the early days of vaccination no improvement in medical treatment has ever loomed so large before the public mind as the two discoveries which decisively enriched surgery by making anæsthesia and asepsis available. Yet, besides a thousand lesser improvements, there have been at least six great triumphs in the domain of medicine, namely :—

(1) Organotherapy, which has already made myxœdema curable;

(2) Sero-therapy, which has already much mitigated the danger of diphtheria;

(3) The treatment of heart disease as not simply a matter of valvular incompetence. but as being often a loss of tone in the heart muscle—treatment which has, I am sure, made a great diminution in the number of the world's invalids;

(4) The almost complete extinction of typhus;

(5) The new knowledge and control of the causes of malaria; and

(6) The open-air treatment, which has not only made consumption a curable and preventible disease, but is likely to change very much for the better the hygienic habits not only of the sick, but also of the hale, and to improve considerably the health of the public.

Of the curability of phthisis in its early stages, both Hippocrates and Sydenham were aware; the latter thought so highly of open air as to say that horse-exercise was as good for the cure of phthisis as quinine for the cure of intermittent fevers. But the public and the medical profession were not teachable, and the " white plague " was the despair and disgrace of medicine.

The people's need, however, is the hero's vocation; and many heroes answered the call: Bodington, MacCormac, Brehmer, Koch, and Walther being the worthy leaders of the movement.

Our intention is to give a rational account of the work of Bodington and MacCormac as related by themselves in 1840 and 1855 respectively. And our apology must be, *first*, that after all it is one of the most important points of a good education that we should be brought into direct contact with those vivacious, original, and discreet minds which have succeeded in eliciting from Nature, as it were, in cross-examination, a few more of her reluctant admissions—for then, if ever, we are in good intellectual company; *secondly*, that by adopting the method of Plutarch and studying Bodington and MacCormac together, we can see how "Wisdom is justified of her children," widely various though they may be in their several qualities, such variety being indeed useful, so that the deficiency of either may be supplemented by the abundance of the other; *thirdly*, that we can realise the difficulties experienced by Bodington and MacCormac on account of the insufficiency of the pathology of their time, and that we may see how they erred in consequence; and, *lastly*, that it is a good lesson for us to see, with surprise and admiration, the degree to which these grave disadvantages were overcome by a plenitude of scientific penetration and clinical insight.

George Bodington was born in 1800, went to school at Magdalen College School, Oxford, whence he proceeded to be apprentice to Mr. Syer, a surgeon of Atherstone, who after a year transferred him to Mr. Wheelwright, a surgeon in London. He then studied at St. Bartholomew's Hospital, became Licentiate of the Society of Apothecaries in 1825, and obtained subsequently the Licence of the Royal College of Physicians of Edinburgh, and the Doctorate in Medicine of the University of Erlangen. He began practising in Birmingham, but soon moved out to Erdington, and thence, farther afield still, to Sutton Coldfield. There he took a large house near his own, "The Driffold," and used

it first as an open-air sanatorium for consumptives (the earliest of such places ever established), and afterwards, when he could bear no longer what I may call the passive resistance of the public and the profession, as a private lunatic asylum. In 1868 he retired and took up public work, attaining the honour of being Warden of the Royal Borough of Sutton Coldfield. Although his pamphlet on "The Treatment and Cure of Pulmonary Consumption" (1840) is his most famous work, he also wrote a much-needed pamphlet against the use of bleeding and calomel in cholera. In fact, he was one of the convinced opponents of the *lowering* system of treatment, amongst the men who, like Graves, stoutly resisted the school of Dr. Sangrado, and "fed fevers." His treatment of consumption received scant measure of justice, but in 1857 the *Journal of Public Health* praised him, and in 1901 the New Sydenham Society reprinted his pamphlet on "Consumption" in its volume of famous monographs. Sir Thomas Barlow, in his address on "Medicine," given in 1902 before the British Medical Association, awards him his due meed of praise, saying plainly that "George Bodington taught, both by precept and by the results of actual experience, what were the proper methods of treating phthisis."* Bodington died in 1882, the year in which Koch announced his discovery of the tubercle bacillus.

Henry MacCormac, born in the same year as Bodington, was the son of a naval officer, and studied in Dublin, Paris, and Edinburgh. He travelled in South Africa and the United States, besides spending some time in Sierra Leone. He obtained the degree of Doctor of Medicine, and became physician to the Belfast Fever Hospital. In 1832 he took charge of the cholera patients of Belfast. Soon he became visiting physician to the Belfast Lunatic Asylum. In 1866 he quitted medicine for literature. He was a man of very wide interests, and is said to have known twenty languages. His long list of publications include works on subjects so varied as "Stammering," "The Condition of the Working Classes," "The Philosophy of Human Nature in its

British Medical Journal, August 2nd, 1902, page 317.

Physical, Intellectual, and Moral Relations," "The Painless Extinction of Animals used as Food," "Secular Education," "The Conversation of a Soul with God," and, especially, "Consumption." He also translated "Epictetus" and "Marcus Aurelius." He died in 1886, four years after Bodington, of whom, I believe, he was quite ignorant, which is a matter of surprise to anyone who knows the vast extent of MacCormac's learning and the marvellous ease with which he handled it all. MacCormac did not found a sanatorium, but contented himself with advocating, in season and out of season, with endless courage, perseverance, and vivacity, the open-air treatment of phthisis. So doughty a champion was the very man whose help Bodington needed; and it is one of "Life's Little Ironies"* that they missed each other, living as they did in neighbouring islands for eighty-two years.

We will now give an account of Bodington's views as set forth in his little book on "The Treatment and Cure of Pulmonary Consumption" (Longman, 1840). He takes as his starting point the teachings of Sir James Clark, who founded them in great measure on the pathological work of Carswell. But he declares at once that "the faultiness of the theories of the day is one of the causes of the excessive mortality arising from consumption,"† namely, one-fifth of the deaths in England, or one-fourth of those in the great towns like Manchester and Birmingham.‡ "Cures," he says, "are scarcely ever heard of, and never expected: despair seems to have taken full possession of the medical profession as regards this destructive disease, and none but the feeblest efforts are exerted to oppose its progress."§ Accordingly he proceeds to give us a wonderfully reasonable theory concerning the process of tuberculosis, the circumstances which exacerbate or retard that process, and the curative treatment of the disease.

The cause of tuberculosis he does not name, because he does not know it, though he points out that in the case of

* *See* Thomas Hardy's Book.
† Page iv.
‡ Pages 7, 47.
§ Page 7.

the Sheffield grinders it may be the metallic and stoney dust inhaled.* His clinical insight, however, makes him declare this cause to be a foreign body,† a statement established by Koch in the year of Bodington's death. Here Bodington differs from MacCormac, who held that the cause was deficiency in oxidation of the body's carbonaceous material. This foreign body, whatever it might be, was believed by Bodington to affect primarily the pulmonary nerve endings. "Taking first the higher order of organisation, the nervous filaments spread out on the organ thus affected, we should infer that their power would be so affected by the presence of the foreign body as to be wasted or lost, so that by diminished power they could no longer control and preserve in healthy action the blood-vessels, cellular tissue, and other portions of the common organisation; and as this action of the deposited matter would occur upon the extremities of the nerves, the capillary vessels would be affected by the loss of nervous power, and, losing in consequence their contractility (or some portion of it), become dilated, swollen, and congested; and then would follow the usual phenomena commonly called inflammation, terminating in suppuration or ulceration; that is, these vessels, losing the aid of nervous influence, are no longer able perfectly to perform the office of hydraulic tubes carrying a fluid containing solid particles in solution‡—the blood; hence congestion, obstruction, and collection of the solid parts of the blood in these vessels takes place, terminating in abscess, ulceration, gangrene, or re-solution."§ Bodington's theory, therefore is that a foreign body finding its way into the lungs damages the nerve-endings, and thereby produces an atonic passive congestion and an atrophic necrosis. When we think of the striking clinical signs of phthisis which point to local pulmonary mischief—hæmoptysis and purulent sputum—and consider also what we find in the lungs *post mortem*, we may fairly say that Bodington's theory shows good knowledge and judgment. His knowledge concerning the inflammation and degeneration of

* Page 46.
† Page 48.
‡ We should now use the word *suspension*.
§ Page 49.

an organ consequent on damage to a nerve was gained from "the experiment of Majendie, who divided the orbital branch of the fifth pair of nerves within the cranium of a living animal, the consequence of which was that the eye became affected with all the symptoms and appearances of what is called intense inflammation, and blindness ensued."*

Once Bodington had come to believe that pulmonary tuberculosis was substantially a *neuropathic necrosis*, he readily inferred that the cure must consist substantially of an exaltation of the vital processes. "The nutrient, muscular, and sanguiferous systems must be maintained in the highest perfection that is possible; the nervous system quieted, subdued, and rendered obtuse."† In other words, the patient must have plenty of food, air, exercise, and sleep. "This, then, is to be aimed at—a healthy nervous system, which will embrace in its consequences due sensibility, motive power, nutritive and reparative power—conditions necessary to resist and overcome the morbid influence arising from the presence of tuberculous matter."§ "Here is, then," he adds in a summary passage, "first, nervous power altered, weakened or exhausted; then the destruction of the remaining tissues constituting the main substance of the organ. To preserve the latter, the integrity and strength of the former must be maintained; and upon the means necessary for that purpose the whole question turns." ‡ *The disease being a neuropathic necrosis, the treatment is a neurotonic vitalisation.*

Having shown the *idée mère* of Bodington concerning the nature and cure of pulmonary tuberculosis, and reduced it to a formula, we must now consider his treatment more in detail. He had a very clear view as to the type of human being to which he desired his patients to conform. "Those persons who are for the most part the freest from the attacks of consumption, such as agricultural labourers, are commonly but little troubled with nervous disorder; they are rather remarkable for an apparent obtuseness of nervous

* Page 51. *See also* Landois and Stirling's Physiology, 3rd edition, p. 593.
† Page 12. § Page 17. ‡ Page 11.

susceptibility; and this is in strict keeping with fully-developed muscular, nutrient, and sanguiferous powers. This nervous quietude harmonises exactly with this condition of the latter powers; it is a plain inference that, to guard against the attacks of consumption, the condition of the patients should be assimilated as much as possible to that of the above-named class of individuals."* We would add parenthetically that patients ought to be better fed and better lodged than agricultural labourers are. Still, Bodington makes it quite clear that his ideal is: A sound mind (slow and sure) in a sound body (muscular and full-blooded).

As regards food, Bodington joins issue with all those who advocate a lowering diet; but he does not himself advocate any disgustingly high degree of superalimentation. "Sir James Clark," he says, "rather sarcastically alludes to what he terms the *beef steak and porter system*, which he decidedly condemns, apparently guided by the phlogistic theory. I could never recommend porter and beef steaks to any person suffering from tubercular consumption—not from any preconceived notion of phlogiston, but on account of its very grossness and unfitness for a consumptive patient; on the other hand, neither could I recommend to such a one, from a prejudice in favour of the aforesaid theory of phlogiston, a meagre diet of vegetables, rice and water, aided by tartarised antimony. I should recommend to one thus consuming away under the influence of this *wasting disease* a nutritious diet of mild fresh animal and farinaceous food, aided by the stimulus of a proper quantity of wine, having regard to the general state and condition of the patient. If this is to be called the beef steak and porter system, then I am guilty of patronising it; but to my mind it rather has the character of a preservative system—while the wasting plan is as much entitled to be called the destructive one."† We may say that the amount of wine usually given by Bodington was two glasses a day, corresponding to about one ounce of alcohol. At the present time alcohol is not in very good repute; milk is usually given as a beverage for consumptives, and milk goes very badly

* Pages 11 and 12. † Page v.

with wine and ale, and not particularly well with spirits. Personally, I disapprove of superalimentation for consumptives beyond that degree of over-eating that all of us can practise with enjoyment. In a word, Bodington's remarks concerning food are substantially correct even in these days.

As regards exercise, there is no doubt that he allowed it beyond what we should now think quite right. He had no clinical thermometer to inform him how the patient's temperature rose and fell in response to exercise and rest. Horse-riding, donkey-riding, and driving in an open carriage were more used by Bodington than by modern sanatorial doctors as therapeutic measures. But with Bodington, anything which, besides keeping the patient in the fresh air, gave him a little exercise and prevented him from fretting, was highly and rightly esteemed.

Bodington was accustomed to make his patients rise early, believing that no air was as good as the morning air. Consequently he sent them to bed early, often at eight o'clock. Moreover, he believed that, as neuropathy was at the bottom of their pulmonary necrosis, few things were so necessary as sleep. So he used morphia freely, to make sure that his patients should sleep well, using it also in doses of one-tenth of a grain to keep the nerves calm during the day. Sir Thomas Barlow* has demurred to this excessive use of the drug. Personally, I should not like to give the doses ordered by Bodington for the waking hours; but, if a patient is apt to have his night's rest broken by coughing, I think it worth while to give codeine in lozenges at bedtime now and then; thus I am to some extent with Bodington as regards the desirability of protecting the nightly sleep of patients by hypnotics if need be.

But Bodington meant to carry out his ideas with the full courage of his convictions; so, with abounding faith (more than the event justified), he established the first Open-Air Sanatorium for Consumptives. "With the intention," he says, "of further extending this mode of practice, and of reducing it to a system of regularity and order, as well as to

*Address on Medicine to the British Medical Association, 1902. *British Medical Journal*, August 2nd, 1902.

be ready to meet the wishes and hopes of some who may read these few pages, and who might anxiously desire to reap the advantage which this plan promises them, and which some have already obtained to an extent beyond their own, or the expectation of their friends, I have taken for the purpose a house in every respect adapted, and near to my own residence, for the reception of patients of this class, who may be desirous, or who are recommended, to remove from their homes for the benefit of change of air, etc. It is presumed that as the situation is very superior in point of dryness, mildness, and purity of air, the advantages to be derived from systematic arrangements with regard to exercise, diet and general treatment, with the watchfulness daily, nay, almost hourly, over the patient of a medical superintendent, great advantages may be obtained by the consumptive patient treated in this way, in comparison with those to be obtained by the removal of such an one to a boarding house or hotel merely for change of scene; and it is hoped that this plan may meet the approbation of the medical profession, and prove beneficial to many afflicted or threatened with the first symptoms of this direful disease in this neighbourhood or elsewhere."* The sanatorium, for want of support, had soon to be converted into a private lunatic asylum. Possibly it may have struck Bodington that patients who were mad enough to refuse his assistance for their lungs might need it for their brains, but in any case the irony of the change is startlingly and grimly marked.

We must now briefly consider the six cases recorded by Bodington in support of his treatment. Accepting readily his plea that the essay was written "in a somewhat hurried manner, when short intervals of time could be snatched from occupations varied and almost incessant,"† we must be grateful that he managed to convey his message to us as well as he did. So I make no complaint concerning the clumsy and involved style of his sentences, for he did his best, and, after all, succeeded in making me understand him. But I cannot profess to be content with his record of cases, for here

* Page vii. † Page ix.

Bodington falls very far short of a reasonably adequate description of the physical signs observable in the patient before, during, and at the end of the treatment.*

The first case described is that of an awl-grinder, thirty years old, living in the country, suffering in severe cachexia from a tubercular abscess at the apex of one lung. This abscess burst into a large bronchus on Bodington's arrival, and a cavity remained in its place. By feeding, by ensuring sleep, and by thorough æration, Bodington effected what might be called a *cure*, following up the spontaneous attempt at cure involved in the bursting of the abscess. "I got up," said the patient, "about four o'clock, and crawled out of the house as well as I could, and felt, and, I believe, looked, the most miserable, weak, and pitiable wretch in the world. I crept along, panting for breath, towards the common; I thought I must have died on the road. At last I reached Welchman's Hill, and when I began to walk round it, I felt my lungs open, my breathing free, and my strength increase fast. I was now quite sure it was doing me good. I went quite round the hill, and then home, and was so hungry that I ordered a beef steak for breakfast, and ate heartily of it." "The distance he walked," says Bodington, "would be about three miles."† He became convalescent in a week, losing his cough entirely. He soon returned to his work, and whenever he felt a relapse approaching, resumed his early morning walks upon the common, and prevented any fresh attack that might have been impending.

The second case is that of which we have the fullest knowledge, being that of one of Bodington's nieces, who, at the age of sixteen, in 1835, appears to have been in the second stage of consumption, having dulness and probably cavities at both apices, nummular sputum, emaciation, night-sweats, coarse rales, weakness of voice and hoarseness. As her parents had little confidence in Bodington's new theories, they resigned her to his care only as a forlorn hope. A nourishing diet (including two daily glasses of sherry and

* "When you make notes of a case, write so that from your notes alone the case can be perfectly well understood one hundred years hence."—(Dr. Graham Steell to his clinical clerk, 1894.)

† Page 23.

water), combined with rigorous open-air treatment, cured her cough in five months. "I think," she says at the end of 1901,* "it was in February, or very early in March, 1836, that I was first lifted on to a donkey—for I was too weak to walk—and led round the garden; and, in spite of my dear parents' fears, the result proved more than they had ventured to hope for. From that time I began to recover strength. The cough and other unfavourable symptoms gradually decreased, and, though the process of recovery was slow, it has been sure; for now, in my eighty-first year, I am in the possession of fairly good health, and able thankfully to enjoy the many mercies which surround me in my daily life. I have had some serious illnesses in the course of my long life, and have always needed to be careful in avoiding cold, having had several attacks of pleurisy and occasional bronchitis; but on the whole I have enjoyed remarkably good health, and until the last few years have been able to lead an active life. There is no doubt that the mischief in my lung was entirely healed under the skilful treatment of my uncle, Dr. Bodington." This, then, may be considered to be a second-stage case, practically cured in the short space of a few months, and, with a few relapses of tubercular pleurisy, living a long, healthy, and active life.

The third case is that of a lady of twenty-three, who was sent to Bodington as a forlorn hope, with cough, dyspnœa, pain in the side, emaciation, and a pulse of 140. She arrived on the 14th of November, 1836, and left in good health on the 24th of the following December. No physical examination is recorded, describing her physical signs on departure; consequently I am not surprised that she returned in January "after influenza" as bad as ever. She recovered in a month after undergoing again the most rigorous open-air treatment, and remained tolerably well till the publication of Bodington's book in 1840. This is probably a case of phthisis in the second stage improving rapidly under treatment.

The fourth case is that of a manservant with a cavity at the right apex, and a history of hæmoptysis. He was under

British Medical Journal, February 22nd, 1902, page 447, column 2.

Bodington from May 16 to June 11, 1839, when he returned to work "quite recovered, June 18."

The fifth case was of the third stage of phthisis, a boy of nineteen, with dull apices, a cavity at the right apex, muco-purulent expectoration, night-sweats, emaciation, a pulse of 130, a history of hæmoptysis a year before, and of fistula in ano three years before. This was Bodington's worst case; the boy responded to treatment slightly, but died in seven weeks.

The sixth case is one of bronchial abscess, perhaps tubercular. The abscess burst, and, after undergoing open-air treatment and high feeding for a week, the patient went about her business quite recovered.

Now if we set aside the first and sixth cases as being of the nature of abscesses, rather than of common pulmonary phthisis, there remain (*a*) the second case, which is a brilliant success, standing the test of sixty-six years; (*b*) the third case, which was a success, although it was a mistake for the patient to leave Bodington in the sixth week of her first visit, and risky to leave him again one month after she had been forced by her relapse to return to him; (*c*) the fourth case, which was successful at the moment, but was not under observation long enough for us to be sure that he did not suffer an early relapse; and (*d*) the fifth case, which, after a slight response to treatment, resulted in death. We must therefore confess that Bodington does not bring forward nearly enough clinical evidence for the establishment of his case. But a judgment as sound as Bodington's is justified in acting on a comparatively small stock of evidence: so skilled was he in appraising the value and significance of such evidence as he had. In fact, the sound judgment and scanty evidence of Bodington were more scientifically efficacious than the enormous wealth of evidence handled by the far inferior judgment of MacCormac.

We are now in a position to criticise respectfully the theory and practice of Bodington. It has been well said that there are two great factors concerned in the phenomena of microbic disease, to wit, the organism and the environment,

or the seed and the soil, or the microbe and the man. The force of a disease like phthisis varies directly with the energy, hardiness, and reproductiveness of the microbe, and inversely as the energy, hardiness, and reparative power of the man. Of the former factor, Bodington was quite ignorant; of the latter he had a very sound appreciation. There is now, perhaps, an excessive, though diminishing, tendency to lay too much stress upon the microbe as the cause of the disease. But for combating disease we must all learn to rely quite as much on developing and sustaining the resisting powers of man; and, certainly, in the absence of an adequate bacteriology, genius could hardly have taken a happier view of phthisis than Bodington did when he saw it as a neuropathic necrosis. This view is, clinically speaking, half the battle; and if Bodington had received the attention that his essay richly deserved, at least fifty years would have been saved in the combat against this eminently preventible and in early stages) curable disease. The treatment adopted by Bodington was admirably bold, sound, and thorough; and, if he had been properly supported in his enterprise, the challenge cup, so to speak, would not readily have passed into German hands.

Still, I believe that Bodington was too optimistic, and that, if his recorded cases had numbered six hundred instead of six, he would have found that cures took longer to effect than he at first believed, that relapses were commoner, and that (even according to his own theory) a larger number of patients than he had guessed had too little power to resist the necrosis effectually, try as he might to exalt all the vital functions. But I believe that his plan of diet was better than the plan of overloading the stomach and over-taxing the digestive powers. We have, however, improved upon his methods through increasing our clinical precision, especially by means of the weighing machine and the clinical thermometer, though he was probably as well aware as we are of the importance of the pulse-rate. We are also more fully aware than he was of the value of rest, especially as an aid to digestion, assimilation, and repair of tissue.

Still, all these little adverse criticisms are as nothing compared with the great fact discovered by Dr. Robert Koch, and necessarily ignored by Bodington, namely, that the greatest danger of infection lies in the sputum. So long as this was unknown, all sanatoria must have remained very dangerous places. There is no sign in Bodington's book to indicate that he was at all on his guard against the diffusion of phthisis by means of careless dealings with the sputum. And it is in our own dealings with the sputum that we have made the only practical improvement upon Bodington's treatment that can be fairly described as of the first magnitude. The genius of Bodington taught us the main truths concerning the soil; the genius of Koch was needed to teach us concerning the seed; the one showed us how to treat the man, the other how to treat the microbe. In justice to Dr. Koch, we must admit that a sanatorium for consumptives conducted in the twentieth century merely on Bodington's principles, without special regard to the disinfection of sputum, would be a disgrace to the knowledge of to-day; but in 1840 it was quite wonderful that a busy country practitioner like Bodington should, after all, have learned and taught us a doctrine of the first therapeutic importance, which ought to make phthisis as rare as typhus. And I venture to think that all competent judges, who may read Bodington's essay, will rise from its perusal with a strong sense of Bodington's high worth as a "servant and interpreter of Nature,"* of his admirable judgment in appraising the significance of the facts before him, of his sobriety, courage, and felicity in constructing the hypothesis of neuropathic necrosis as being the most consistent with the known facts, and of his enterprise, perseverance, and common-sense in applying his theory to practice. Surely we may affirm that he fairly earned the truths he taught.

We now pass to the work of Henry MacCormac. Bodington wrote one pamphlet on *The Treatment of Consumption*, and was discouraged from writing the larger work that he once hoped to write; MacCormac wrote more than a dozen

* Bacon, Aphorisms, I. † Page ix.

lectures and pamphlets on the prevention of consumption, and never lost heart or hope in all the eighty-six years of his life. Bodington had but a scanty stock of evidence, which sufficed only because of his genius as a great scientific discoverer; MacCormac had at his command the learning of all the centuries and every country, and was in the habit (so to speak) of smothering his opponents under a mass of testimony outpoured from all the experience of the whole medical world.* Bodington preached the curability of phthisis; MacCormac upheld its preventibility. Bodington founded a sanatorium to support his theory by his practice; MacCormac made himself an apostle of his faith, and laboured at persuading directly the intelligence of men. Bodington was soon suppressed; MacCormac battled on to the end with magnificent courage, patience, and perseverance. Bodington formed an admirable scientific theory, as true and as fertile as could possibly be expected in 1840; MacCormac unfortunately made a false start, and upheld even at the age of eighty-two against Koch himself a theory based on singularly crude views of pathology. Both were admirable clinicians; Bodington's practice being much improved by the power and truth of his theory, while MacCormac's was kept wonderfully correct by his unsurpassed learning, wielded

*McCormac's treatment of his opponents reminds me of Lowell's description of Theodore Parker's sermons.

> He bangs and bethwacks them,—their backs he salutes
> With the whole tree of knowledge torn up by the roots;
> His sermons with satire are plenteously verjuiced,
> And he talks in one breath of Confutzee, Cass, Zerduscht,
> Jack Robinson, Peter the Hermit, Strap, Dathan,
> Cush, Pitt (not the bottomless, *that* he's no faith in),
> Pan, Pillicock, Shakspere, Paul, Toots, Monsieur Tonson,
> Aldebaran, Alcander, Ben Khorat, Ben Jonson,
> Thoth, Richter, Joe Smith, Father Paul, Judah Monis,
> Musæus, Muretus, *hem*, μ Scorpionis,
> Maccabee, Maccaboy, Mac—Mac—ah! Macchiavelli,
> Condorcet, Count d'Orsay, Conder, Say, Ganganelli,
> Orion, O'Connell, the Chevalier d'O,
> (See the Memoirs of Sully) το παν, the great toe
> Of the statue of Jupiter, now made to pass
> For that of Jew Peter by good Romish brass,
> (You may add for yourselves, for I find it a bore,
> All the names you have ever, or not, heard before,
> And when you've done that—why, invent a few more.)
>
> —*Lowell's Fable for Critics.*

As McCormac pours out his vast stores of evidence over his luckless opponents, I cannot help thinking of those terrible accidents which occur sometimes when ships are laden with grain by means of large grain elevators; if a man be caught in such a shower of grain, he is infallibly smothered. MacCormac's opponents seem to me to be caught in such a shower of testimony.

always with singular readiness and adroitness,* and by a common sense and force of character of high order.

What rule is to be observed in making theories? Surely the rule that Comte formulated, and MacCormac quoted and adopted, namely, *to form the simplest hypothesis compatible with the whole of the known facts.*† This, of course, involves that the theory will commonly be imperfect and far from true. Nevertheless, it ought to be made in the interest of science; for, even if it be not the true and final theory, it will serve a most useful purpose in giving method and reason to a mass of incoherent facts, and will form a very good starting point for the development of a better theory later on. Theory apart from facts is mania; facts without a theory are but a dead weight for the mind; theory soberly based on all the known facts is science. Thus, in the case of Bodington, we may say that his theory of phthisis as a neuropathic necrosis excited by a foreign body is a good theory, bearing the test of the definition very well; it is something very like "the simplest hypothesis compatible with the whole of the [then] known facts." To be sure, the necrosis is of a very fierce character for any ordinary foreign body to set up; but this objection could not be removed till Dr. Koch's discovery that the foreign body was really a living and multiplying parasite. But Bodington's theory, though not perfect, was excellent. Similarly with MacCormac's theory: we must not be content to find that it is wrong according to the knowledge of to-day; we must see how far it was consistent with the facts as known in 1855. We shall find that it is a poor theory; but that it worked out so well in practice that MacCormac could not be persuaded to alter it:

"Our indiscretion sometimes serves us well
When our deep plots do pall."‡

At the same time, our latter-day theory works out in practice far better still.

Like Bodington, MacCormac first expressed his views in

* The pupils of Julius Dreschfeld know with what readiness and adroitness great learning *can* be wielded.

† Consumption, 2nd edition, Note on page 82.

‡ Shakespere's "Hamlet," Act V., Scene 2.

a small book of a hundred pages.* The first edition was published in 1855; but MacCormac published a second edition, re-written, and much better edited, in 1865. My own references are to the first edition, except where it is otherwise stated; and here and there I shall quote from other essays in order to deal more fairly with MacCormac's train of thought.

We will now give a short account of MacCormac's great essay, the second edition of which he dedicated to his son—probably the highest honour that Sir William MacCormac ever received. Like most men who feel quite sure that they have something very important to say, he affiliates his own work to the previous work of others. "About fourteen or fifteen years after Laennec had produced his great work, *de l'Auscultation Médiate*, another observer, Baudelocque, came forward with his *Études sur les causes, la nature et le traitement de la maladie scrophuleuse*. Here the field of observation was extended; Baudelocque furnished the antithesis to Laennec's thesis, as my own observations and inferences, based on what they have done, will, I trust, prove the synthesis and complement of their labours. Laennec has determined the seat, natural history, and occasional cure of tuberculisation. Baudelocque referred the source of tubercle in the case of scrofula, to which I would conjoin pulmonary and all other tubercle, to the respiration of foul air. To all this I further add that the mechanical amorphous deposition which we term tubercle is itself chemically and physiologically owing to the retention and conversion of the carbonaceous and other impurities not discharged from the blood. These carbonaceous matters, the impurities of the blood namely, are not, cannot be, eliminated in foul air, and, having no practicable healthy outlet, are, with the addition of watery moisture and a small amount of earthy salts, converted into the substance named tubercle. This tubercle, the lung tissue not being otherwise implicated or diseased, undergoes progressive softening and expulsion through the nearest practicable bronchial tube, else by successive deposition and absorption is converted into a cretaceous mass or

* "On the Nature, Treatment and Prevention of Pulmonary Consumption, and incidentally of Scrofula, with a demonstration of the cause of the disease, by Henry MacCormac, M.D." Longman, 1855.

masses, and is either eliminated in that form by expectoration or retained till death in the lungs. I thus complete the last links of the chain of morbid causation, and, as I would fain believe and hope, place the problems hitherto incomplete and unresolved, of the treatment and prevention of pulmonary and other tubercle, upon the sound and unassailable basis of medico-scientific observation and inference."* What he proudly calls *MacCormac's Law* runs thus :—" *Wherever the air habitually respired has been respired, in whole or in part, before—there tubercular deposits are found; and wherever the air habitually respired has not been respired, in whole or in part, before—there tubercular deposits are impossible, and consumption and scrofula are unknown.*"† " So long as science lasts, my theory must stand. Carried into action, it will yet rescue uncounted millions from protracted wretchedness and a living death. It will help to elevate the physical status of our kind, and, graven on a medium haply more imperishable than the poet's monumental brass,‡ shall long subsist in the appreciation of an intelligent and, fortunately for themselves, acquiescent posterity."§ I believe that MacCormac's theory is weak; yet the prognosis and treatment, which he based upon the theory, are sufficiently sound to warrant the above strong and confident language. The motto of his second edition is the famous phrase employed by Thucydides to show how high he aimed in writing his history— κτῆμα ἐς ἀεὶ, —*a possession for ever.*‖ I think that, on the whole, these hundred pages *have* a permanent value, on account of their learning, their hygienic, therapeutic, and prognostic force, their medical common-sense, their moral earnestness, their pathetic appeal, and their abounding faith. If the theory was weak, the man was strong.

In his preliminiary remarks, MacCormac calls phthisis the *opprobrium of medicine*, as having baffled inquiry and been abandoned most extensively to empiricism and despair. " The writer is of opinion that the malady, which constitutes

* Pages 66–67, cf. 2nd Edition, page 131.
† Introduction to 2nd Edition, page 28.
‡ Horace, Odes III., 30, 1.
§ End of Introduction, 2nd Edition.
‖ Thucydides I., 22.

nearly a third of all chronic diseases, and perhaps a fifth of the actual mortality of the human race, may be brought into narrow limits, if not entirely set aside."* He also makes a point of the fact that phthisis is especially deplorable, in that it kills by preference people between twenty and thirty years of age "in what else might prove the very fulness and vigour of their prime." Then follow the seven chapters of the body of the monograph.

I.—*On the Nature of Consumption.*—The symptoms of consumption are declared to be owing to the irritation created by tubercle in the tissues and in the blood. Tubercle is said to be "a foreign body," making its appearance only "as the result of a profound and deeply-seated degradation in the vital functions of man and animals."† It exists not only in the lungs, but also often in the larynx, the liver, the bronchial and mesenteric glands. In the lungs, tubercles commonly soften and are discharged through the contiguous bronchus. Tubercle may dry up and be converted into a cretaceous mass. Now and then a cavity heals up by an effort of nature, or is found *post mortem*, lined with a "semi-cartilaginous membrane."‡ But tubercle often exists in the organism long before the stethoscope can detect it; and other signs also must be considered, such as the expectoration, the quickened pulse and respiration, night-sweats, diarrhœa, hectic, loss of weight, etc.

II.—*The Constitution of Tubercle.*—MacCormac says that a tubercle consists chiefly of a hydro-carbon, together with a little added mineral waste. Under the head of hydro-carbon he also includes fat.§ Scherer is quoted as saying that crude pulmonary tubercle contains 54 parts of carbon, 7 of hydrogen, 17 of nitrogen, and 21 of oxygen. Nothing, says MacCormac, can possibly be more conclusive than that carbon is the "solid predominant ingredient." But, in point of fact, Scherer's analysis is closely representative, not of carbo-hydrates, but of proteids, the usual percentage composition of which is said to be: Carbon 51.5 to 54.5, hydrogen

* Page 1.
† Page 7.
‡ Pages 8, 61.
§ Page 108, 2nd Edition.

6.9 to 7.3, nitrogen 15.2 to 17, oxygen 20.9 to 23.5.* Thus MacCormac cannot fairly quote Scherer's analysis in favour of his theory of the composition of tubercle.

III.—*Rational or Vital Cause of Tubercle.*—This is the tubercular temperament; and the cause of this tuberculous cachexy is twice-breathed air. The idea of consumption being hereditary is scouted by MacCormac. "Consumption is not more communicated by any infection or contagion whatever, any more than a fractured limb is so communicated."† If consumption runs in families, he says, it is because the whole family is exposed to re-breathed air. Here MacCormac's doctrine is a public danger: for it is wrong to assure people that consumption cannot be caught. It always is caught, but the infectiousness is reduced almost to zero in the open air. MacCormac denies also the theory of the inflammatory origin of phthisis, although Broussais had noticed the close connection of phthisis with pleurisy and pneumonia.‡ Phthisis is now known to be an inflammatory process, a kind of chronic pneumonia, tending rather to necrosis than to resolution.

IV.—*Proximate or Chemical Cause of Tubercle.*—"For the first time in the history of disease, the proximate source of tubercle deposits is, in my opinion, capable of exact demonstration. . . . Tuberculous scrofulous deposits, then, whether in the offspring of scrofulous consumptive parents, or the offspring of persons free from scrofulous tuberculous disease, are alike and in every case owing to the insufficient, imperfect performance of the respiratory function. The carbon is retained—in other words, it is not discharged or sufficiently discharged from the blood in the lungs—and, finding no adequate outlet by the liver, skin, or other possible emunctories, being neither burnt off in the lungs nor expended in the tissues, is deposited mainly as a hydro-carbon, in the lungs and other organs, under the form of the body known by the designation of tubercles. . . . A diseased action is

*Hoppe-Seyler, quoted in Landois and Stirling's Text Book of Human Physiology, 3rd Edition, page 375.

† Page 14.

‡ Propositions de Médecine, 166, 404.

necessarily set up, and hectic, wasting, final decay, and death are the result."*

"Oxidise the effete carbonaceous waste, and it is got rid of, and disappears; do not oxidise it, and it will remain in the organism under the guise of tubercle, and no other."†

At this rate, one would think, the open-air treatment ought never to fail. But now that we know what power is exerted by microbes, we may perhaps rather wonder that the treatment succeeds as well as it does.

V.—*Remote or Predisposing Causes of Tubercle.*—These causes are whatever circumstances impede the oxidisation of tissue. Stuffy bedrooms, sedentary occupations—life in cellars, jails, barracks, asylums, schools—these, with great wealth of illustration, from Norwood to New Zealand, are indicated as just so many powerful predisposing causes of phthisis.

VI.—*On the Treatment of Consumption.*—The healing of cavities in the lungs, and the calcification of tubercular deposits as found by the necropsies performed by Louis and Laennec—"what are these but instances of recovery?"‡ "In fact, nature endeavours to remedy every case of tuberculous deposit, and would succeed vastly oftener in her endeavours, as they may most justly be characterised, did we only second them by suitably adjusted treatment."§ "Tubercles may be directly expelled, and the cavities heal, but the tuberculous matter is susceptible of repeated, continued, and complete absorption, with the exception of the earthy ingredients. . . . Every such absorption of tuberculous matter, philosophically speaking, must be looked on as an attempt at recovery, every fresh deposit of tuberculous matter as a fresh attack. How numerous, then, might be the happy issues from these critical librations—balancings of nature between life and death—did more fortunate circumstances only happily second her efforts."‖ "When the whole system is, as it were, given up to the enemy, we cannot

* Page 23. † Edition II. page 116. ‡ Edition II. page 129.

§ Page 64.—In the 2nd Edition MacCormac adds, "and especially by the unlimited supply of unprebreathed air, without which all treatment is utter waste of time and means." page 130.

‖ Pages 68 and 69.

hope to do much."* "We may alleviate suffering, and, if we only witness the malady early, may prolong life, perchance effect a cure."† "Phthisical sufferers, their malady being overcome, often live to an advanced age."‡ "A pure, fresh, untainted atmosphere, at all hours, times, and places, is the one single condition which nothing whatever must interfere with or set aside. Arrangements, therefore, must be made in which, while by means of flannels, silks, furs, chamois vests by day, bed-clothes warm and fleecy by night, aided, if needs be, by coverlets of cotton, goose- or eider-down and open fires, bodily warmth is effectively sustained, there shall be a ceaseless unlimited supply, day and night, winter and summer, of a pure fresh atmosphere in the apartment of the sufferer. The patient must, in short, live in the open atmosphere."§ "The constant and most unnecessary dread of taking cold, which haunts the minds of patients and their friends, is doubtless one cause why fresh air is so thrust aside." "And yet, cold will not be caught, were it in Nova Zembla itself, by night, if only the sleeper's body be adequately covered, the clothes well tucked in under the chin, and the coverlet corner thrown over the exposed ear."‖ "The air is as good, nay, better, by night than by day."¶ "If the open air by night were hurtful, the birds of the air and the beasts of the field must have perished long ago."** "If at all able, locomotion on foot is desirable, or, as Sydenham and Desault and Rush have recommended, by exercise on horseback, or on that humble but excellent substitute, a donkey."††

MacCormac proceeds to recommend a rich diet with tonic and hæmatinic medicines. "Roast meats and boiled, fish and flesh and fowl indeed, both wild and tame; oysters, milk, fresh curd, and farinaceous matters; good bread, vegetables, fruit; tea, chocolate and coffee, sugar, good wine, porter and brandy, all under judicious regulation and management, are

* Page 69.
† Page 69.
‡ Page 70. "And why not?" he adds in his 2nd Edition, page 132.
§ 2nd Edition, page 133.
‖ 2nd Edition, page 135.
¶ Page 76.
** Page 77.
†† Page 78.

the fitting aliments of the consumptive. . . . The accomplished physician is perfectly aware of the different bitters, the cusparia, the calumbo, the orange-peel and the quinine, the various and excellent preparations—the citrate, lactate, and others—of iron."* In short, MacCormac orders "a liberal restorative regimen."† He also recommends tepid baths or tepid sponging—an education of the skin which, I think, can usually be counted upon to reduce pyrexia one degree. He then most sensibly recommends the avoidance of "harsh accents" and "vexatious contrarieties," and enjoins "genial service," "the utmost cleanliness, and even elegance."‡

VII.—*Prevention of Consumption.*—MacCormac "confidingly and unhesitatingly" asserts the possibility of "getting rid of consumption altogether."§ Then he warns us of the existence of a "borderland of disease," a "neutral state," occupied by thousands, from whose ranks the roll of consumptives is daily recruited.‖ "There are thousands, and tens of thousands, who, although they do not so far labour under tubercle, are yet as prey prepared for the destroyer. They constitute, in short, all those on whom consumption has not seized, but who, unfavourably circumstanced as they are, shall presently replace the current victims of the disease. . . . Those . . . I would without a moment's delay remove from their sickly environment, and, while it was yet time, plunge into a healthier, wholesomer medium."¶ He then urges the substitution of machine labour for handiwork in all possible unwholesome occupations, and pleads tenderly for plenty of fresh air and exercise for the young. This concludes our abstract of MacCormac's essay.

If I may now venture respectfully to criticise MacCormac's theory, it must be after having handsomely admitted the high value of his views concerning the importance of pure air for respiration—views which, as he gladly avows, were held by Baudelocque before him. But the thesis, *that pure*

* Page 83.
† Page 84.
‡ Page 86.
§ Page 91, 2nd Edition, page 142.
‖ Page 93.
¶ Page 95.

air hindered consumption, while foul air promoted it, was far too vague to content MacCormac, who gave the carbohæmia explanation of the disease. This, at first sight, is not an absurd theory, being, as MacCormac says, closely comparable with the theory of gout.* In gout we have a faulty metabolism, due largely to excessive nutriment and insufficient exercise; in gout we have a defective elimination of uric acid from the blood and chalky deposits of biurate of sodium in the joints, coupled with much constitutional disturbance. And as gout is a disease caused by faulty *nutrition*, and characterised by a substance circulating in the blood and deposited in the joints—so, urged MacCormac, is phthisis a disease caused by faulty *respiration* and characterised by a corresponding substance circulating in the blood and deposited as tubercle in the lungs, larynx, peritoneum, bones, glands, etc. If in gout the uric acid is not sufficiently oxidised to form urea and be excreted as such by the kidneys—so, thought MacCormac, in phthisis the fatty carbohydrate called tubercle was insufficiently oxidised to form carbon dioxide and be excreted as such by the lungs. This is indeed a striking analogy; but it needed a verification far more severe than MacCormac ever gave it. Anyone, for example, who, after a necropsy, looks at the lung of a man who has died of phthisis, will feel that the decay and destruction of the part suggests a great deal more than a mere deposition of fat and carbohydrates, and that Bodington showed far more common-sense and insight in considering the process to be one of necrosis rather than of infiltration and deposit. We are not surprised that MacCormac's theory of carbonaceous deposit found so little favour with his contemporaries; and he must surely have been too strongly prepossessed by the

**See* page 29. "If Nitrogenous food be taken in excess, beyond the wants of the system and supply of the azotized tissues, deposits of urate of soda will be formed from the blood in the joints, irrespective of calculi in the bladder and kidneys. And thus it is that a morbid or perturbating influence, deranging the excretory and secretory functions of the blood, shall cause the deposition of tubercles in one case, as it does that of uric acid deposits in the other.

See also MacCormac's thirty-second Aphorism, 2nd Edition, page 234. "The theory which, with all the force of conviction, I would press upon the consideration and adoption of all thinkers, inquirers and observers, is that tubercle results from the arrest of the retrograde or interstitial carbon within the economy; is, in fact, no other than that waste or excrementitious carbon, itself; just as in certain states of the economy, the waste or excrementitious nitrogen gathers in the blood, and is itself deposited (as urate of ammonia, say,) in the living tissues."

theory of gout before he could have believed that the phthisical lungs of the *post mortem* room were so radically disorganised by a mere deposit. If Bodington in 1840 had, at the necropsy of a phthisical case, shown us the disorganised lung, saying, "This is a bad case of necrosis, such as would happen if the innervation of the part had been by some unknown means destroyed," we should probably have listened with acceptance. But surely we should have been quite unconvinced if MacCormac had expected us to believe that the condition of the lung was due merely to infiltration and deposit; we should have been inclined to remark: "This man knows too much about gout." Of course, now that Koch has shown us that the disintegration of the lung represents the ravages of a real live foreign enemy, we feel that Koch's microbic theory is even more consistent with the look of the lung than Bodington's theory of neuropathic necrosis. And Bodington never knew, nor thought he knew, how it was that the local nerves turned so incompetent.

Moreover, we have long had knowledge of a disease which is really almost exactly what MacCormac thought phthisis to be, namely, a deposition of superfluous fat amongst the tissues: we mean obesity. But obesity, troublesome as it is to the muscular, respiratory, and circulatory systems, presents characteristics which are in the main quite opposed to those of phthisis, although for a short time the two diseases may co-exist in the same person. Surely we may say that MacCormac ought to have seen that if his theory were true, his phthisical patients ought to have looked far less like the "lean and slippered pantaloon," and far more like the "justice in fair round belly with good capon lined."* Again, a febrile condition is the rule in phthisis; that is to say, the combustion of carbon in the body tends to be not defective, but excessive; so that, if in truth phthisis began by being due to an excessive deposit of carbohydrate and fat in the tissues, it would always undergo a swift and spontaneous cure, by means of the excessive combustion of carbohydrates and fats supervening in its course. We may also note, by

*Shakespere, "As You Like it," Act II., Scene 7.

the way, in view of the rich diet prescribed by MacCormac for phthisical cases, that (with considerable inconsistency) he took no precautions for lessening the ingestion of fats and carbohydrates, beyond pouring contempt on cod liver oil, the ingestion of which he compares with "touching for the king's evil."* The close connection which Broussais had noticed between tuberculosis and inflammation† does not receive from MacCormac the notice that it deserves. Amongst other phrases of Broussais is the very striking one in which he calls phthisis a *chronic pneumonia*.‡ Broussais also taught the important clinical truth that phthisis often began with an attack of pleurisy.§ Further, MacCormac did not attach due weight to an acute and indeed decisive objection made by a Dr. Richardson, who said that in cyanosis and emphysema the blood remained highly carbonised, and yet the patients commonly escaped tubercle. Surely this objection ought to have made MacCormac reconsider, or even lay aside, his theory of carbohæmia; but he hardly notices it.‖ We may add that MacCormac, like Bodington, was wholly off his guard concerning the infective dangers that lurk in the sputum.

We must, therefore, on the whole, award MacCormac a meed of praise less pure than that we gave to Bodington. His pathological theory of consumption was very crude, an analogy taken from the facts of gout being persistently pressed in the face of the strongest evidence and reason. The weakest part of his case was naturally the part which others spent most time in attacking, and he used most energy and resource in defending. But, poor as MacCormac was in scientific theory, he possessed a vast store of clinical evidence, and, having once hit upon an excellent line of treatment, pursued and perfected it with admirable medical instinct. As regards *prognosis*, we may say that he was certainly superior to Bodington, being decidedly less optimistic

* 2nd Edition, page 65.

† Propositions de Médecine, 168. "Je n'ai jamais vu de tubercules du poumon, sans une inflammation antécédente.

‡ Idem 171, 404.

§ Idem 166. "La pleurésie qui predomine dans la plèvre pulmonaire, avec ou sans collection et atrophie du poumon qu'elle recouvre, enflamme quelquefois ce poumon et peut, en cas de chronicité, y developper des tubercules."—*See* MacCormac, ed. II., p. 110.

‖ 2nd Edition, p. 84.

as regards possible cures. As regards *treatment*, we may rank the two men almost on an equality, both being quite clear as to the need of a good nourishing diet, and quite uncompromising as to the need of open air by night and by day; and, while Bodington seems more skilful in the treatment of cough and sleeplessness, MacCormac shows a better appreciation of the value of rest in febrile conditions, and seems wiser in his care about clothes and bodily warmth, and in his use of tonics and hæmatinics. MacCormac has the advantage over Bodington in his very clear view that consumption, though difficult (and in late stages almost impossible) to cure, is easily preventible, and that the energy of reformers ought to be bent rather on the great and feasible task of prevention than on the difficult and far less important task of cure.

In view of the fact that MacCormac's pathological *rationale* of phthisis was so bad, can we say that he fairly earned the right to lecture us as he did on the subjects of treatment and prophylaxis? On reflection, we may answer that he earned his truths *fairly*, though he did not earn them as handsomely as Bodington had earned his. For, take away "MacCormac's Law," and there still remains the doctrine which MacCormac had inherited from Baudelocque and Fourcault, *that foul and pure air were respectively the cause and the cure of tuberculosis;* and there remains also the enormous weight of varied evidence collected from all times and places by MacCormac's clinical experience and sagacity, patience and perseverance, erudition and memory—evidence enough to establish permanently, not the carbohæmia theory, but the practice of an enlightened ærotherapy. In other words, MacCormac's evidence did not prove his whole theory; but it proved enough of it to justify the new treatment. It has been truly said of Bodington that he has shown us how practice may outstrip theory; it is true to a far greater extent of MacCormac. And thus we may fairly admit MacCormac's claim to rank as one of the foremost champions of the crusade against tuberculosis; for, if he was weaker than Bodington in pathological

theory, his immense reserves of evidence gave him strength equal to Bodington's as regards treatment, and much superior as regards prognosis, prophylaxis, and public health. As an apostle of what he knew to be a great cause, he is admirable, his pugnacity contrasting very finely with the pathetic submission early adopted by Bodington.

Enough has been said to establish Bodington's claim to rank amongst the pioneers of medical science; for, starting with a reasonable discontent at the therapeutics of his day, he took a competent and vigorous review of the facts, and formed a wonderfully reasonable theory, which he successfully tested in his practice. Before any important advances could be made on Bodington's theory or practice, the world had to wait forty-two years, till Koch was ready with his demonstration of microbic action. Enough has also been said, perhaps, in demonstration of MacCormac's practical rightness, coupled with his somewhat perverse theoretic wrongness. It is, indeed, difficult to understand how a man so learned, so vigorous of mind, so sound in judgment, so piercingly observant and discerning as MacCormac, should have been so helplessly subjected to his weak theory of Carbohæmia as to be unable to realise the force of the obvious, fatal, and freely-stated objections to which it lay open; still, such surprises always await the student of human nature, and it is our own fault, not MacCormac's, if we do not understand how a wise and good man of inflexible courage and constancy may continue to hold a position long after it has ceased to be rightly defensible; for thus Priestley himself clung till death to the phlogistic theory. So to MacCormac, on the whole, we must give a tribute of gratitude less pure, but hardly less large, than that we gave to Bodington. If he thought worse, he fought better.

THE BIRTH, MARRIAGE AND DEATH RATES.

By HENRY MAY, L.R.C.P., *late Medical Officer of Health for Aston Manor.*

MEDICAL men are so accustomed to regard the annual birth-, marriage-, and death-rates as reliable guides to the variations in the mortality of the country, and to the relative frequency of the other social occurrences to which they refer, that it needs a good case to justify any attempt to cast a shadow of doubt on the value of the inferences to be drawn from them—yet such is the aim and purport of these remarks.* A very considerable change has taken place in the age-constitution of the population in the last two decades and a portion of a third; and the annual rates for the years preceding the change, and in a lesser degree those recorded while it has been in progress, are no longer fairly comparable with those of the present time. It is as if our social barometer had been lifted into a different atmosphere, and shifted through varying altitudes, so that its readings must be reduced to sea-level and corrected accordingly.

This disturbance in the normal age-distribution of the population is an exceptional one, and it has probably had no counterpart in ancient or modern history. The rapid decline in the birth-rate which followed upon the abounding fertility of previous years has naturally been followed by a great decrease in the proportion the young bear to the whole population. There was very little divergence shown by the 1881 census from the age and sex relations of previous censuses, but the 1891 census showed great differences between them in respect of age. The most noticeable was a falling-off in those living under five years of age from 136 to 123 per 1,000 of the population. The 1901 census showed a decrease during the twenty years of from 365 to 324, per 1,000 of the population, of those living under fifteen years of age, accompanied with an increase of from 259 to 284 per 1,000

* This subject has been already referred to in a Paper read by me at a a Meeting of the Midland Branch of Medical Officers of Health, and published in *Public Health*, June, 1904.

between twenty-five and thirty-five, but at the same time with very slight divergence in regard to sex. The 1911 census may be expected to reveal a decrease in persons living under twenty-five years of age, with a larger proportion of older persons. Thus there is no permanency in the age-conditions of the population, and no finality to be looked for in them for several decades.

Though it is probable the maximum has now been reached, such important changes as these demand corresponding alterations and corrections in the rates to render them suitable for comparison. It is well recognised that the number of the births, marriages, and deaths is to a large extent dependent on the age-characteristics of the population. The General Report on the 1901 census says that "sex and age-"constitution may be fairly considered the key to vital "statistics, and is of nearly equal importance in relation to "all other statistical inquiries in which the numbers of the "people are involved" (p. 49).

The death-rates have the strongest claims on our consideration, as they are intimately connected with sanitary questions and matters of health and life generally, besides their economic relations with life-assurance; neither are the necessary materials wanting for proper adjustment. The ages and sex of all deaths are registered, and when the numbers living at each age and sex are obtained, it becomes a matter of calculation to find the special death-rate for each age-period and the total corrected rate. In his last two annual reports, for 1901 and 1902, for which the age-statistics of the 1901 census were available, the Registrar-General for England and Wales enters fully into this subject. He says that "general death-rates cannot be safely used in compar-"ing the mortality of one cause with that from another "cause, or in comparing the mortality from the same cause in "different periods, unless full allowance be made for age "differences in the several populations concerned" (Annual Report for 1902, p. xviii.). He supplies a table of the annual death-rates of the country corrected for age for past years, showing the rates that would have been recorded had

the age and sex constitution of the population been the same in those years as at the last census. "Generally speaking," he says, "the effect of correction is to lower the rates for "1880 and earlier years by about 1.0 per 1,000, and those of "later years by smaller and decreasing amounts" (Annual Report for 1901, p. xvi.).

The better way to obviate these difficulties is to adopt the plan, whenever possible, of using rates based on the number of persons living at the special age concerned, rather than on the total population at all ages. The annual infantile death-rate has come to be always given in terms of the number of births registered during the year, and requires no correction. In 1902 the deaths from measles that occurred among children under five years of age were 93 per cent. of the whole number, and from whooping-cough 97 per cent.; and Table 31 has been adopted by the Registrar-General, giving the mortality rates from the chief diseases of childhood occurring among children under five years of age at the rate per 1,000 of those living at that period of life, instead of for the whole population, and this method is capable of farther application.

So far official statistics dealing with correction for age have been chiefly concerned with the death-rates, but there is the same need for correction in the marriage- and birth-rates. Though they hold a secondary place in our estimation, they are matters of much public interest in their relation with the decline in maternity which occupies so much public attention at the present time. Unfortunately, the information that is needed for their correction is not complete, as the mother's age is not required on the register of the birth, nor is the number of children she has borne wanted for the census. It is, however, easily demonstrable that the proportion of persons of marriageable and child-bearing age is much greater now than in the years preceding 1880. It is true a small portion of the annual marriages and births take place before twenty or over forty-five, but the intervening period may be considered as fairly representative of the marrying time of life. The number of persons, male and female,

living between those ages was 349 per 1,000 of the whole population in 1881, and 380 in 1901, so that it would mean an addition of 1.5 per 1,000 to the marriage rates of the earlier years to put them on an equal footing with those of the present as regards persons among whom marriages take place. The average marriage-rate for the period 1871-80 was 16.2 per 1,000, and, though it fell somewhat in the intervening years, it has now remained steady for several years at about 16.0 per 1,000, and thus correction for age shows a falling-off in marriages of fully 1.5 per 1,000 of the whole population. A similar conclusion is arrived at by the Registrar-General, who says in his last annual report that "it is manifest the "total population is not a satisfactory standard by which to "measure the rate of marriage, and has decreased in propor- "tion to the section of the population among which marriages "take place" (Annual Report, 1902, p. vi.).

Neither do the annual birth-rates take any heed of the varying proportion of women in the population who are of child-bearing age, but assume that it remains constant. These rates eminently require correction for age, and when this has been made it is evident that the recorded rates do not give the full measure of the birth-fall. They show a decline in the two decades from 35.5 to 28.5 per 1,000 of the total population; in the meantime the proportion of women living at the usual child-bearing age (twenty to forty-five years) has greatly altered, viz., from 181 to 199 per 1,000 of the whole population. If the age and sex constitution had been the same as now in those earlier years—and the sex proportion has scarcely varied—their birth-rates would have been at least 3.5 per 1,000 higher, so that the extent to which the reproductive function has fallen into desuetude is really represented by a decline of 10.5 in the birth-rate.

In any attempt to assign the proper share which different influences have had in bringing about this great decrease in fertility, it must be remembered that there has been no increase, but the reverse, in the proportion of children born out of wedlock. Not only are the married persons fewer in number, but a condition very unfavourable to reproduction

must be taken into account in the postponement of their marriage to a later age. According to the official marriage statistics, the proportion who marry under twenty-one has fallen since 1881 from 78 males and 217 females per 1,000 marriages to 47 males and 154 females in 1902; and the last Census Report shows that a steady decrease has been going on for the last thirty years in the proportion of married ages under twenty-five years.

Whether this prudential restraint on marriage be regarded as favourable to the public welfare or otherwise, it must be acknowledged that the accumulating effects of these influences year by year go a long way to explain the declining maternity, and that only a part of it can be assigned to artificial restrictions on the fecundity of marriage.

The figures used here are for the whole of England and Wales, but the change in age-constitution is far from uniform, and there are places where the disturbance is much greater than the average. For them, correction for age is still more necessary to arrive at the real alteration during the last ten years or more in their births, marriages, or deaths.

Before concluding these remarks, it is as well that something should be said as to how far, in the changing circumstances of the population in regard to age, the annual rates used in their crude state remain worthy of trust. Of course, as a statement of fact for the year to which they refer, they are accurate, and for neighbouring years the margin of error is negligible; some error is inevitable owing to the fact that the extent of the age variations are ascertained at ten years' intervals. When the period for comparison, or for taking an average, is above five years, the inferences must be taken *cum grano salis*, and when the interval exceeds ten years it is desirable to ascertain if due allowance has been made for age differences and the value of these influences estimated accordingly.

REVIEWS.

A Text-Book of Pathology. By ALFRED STENGEL, M.D. Fourth Edition. W. B. Saunders and Company. 1903.

THAT a text-book should pass through four editions in five years is sufficient evidence of its worth. The present edition of the above work has been considerably enlarged, and in places practically re-written. The chapter on the Theories of Immunity, which is one of those which have been re-written, is one of the best résumés of a very difficult subject which we have seen. The illustrations are in places somewhat rough, but on the whole distinct, and they bring out the required points. Which is, after all, the essential thing; some of the coloured plates are, however, somewhat misleading. The appendix on Methods of Pathological Technique, which is a new feature in the work, is excellent. It is, we venture to think, a mistake nowadays to attempt too much in preparing a text-book of pathology for students, as much may be left to the writers of text-books on Bacteriology and Practical Pathology, but we have seldom seen a more compact and accurate description of the methods best suited for everyday work in the laboratory than that in the appendix to the present volume. It greatly enhances the value of the book.

Text-Book of Histology, including the Microscopic Technic. By Dr. PHILIP STOHR. Edited, with additions, by Dr. ALFRED SCHAPER. London: Rebman, Limited. 1904.

THIS, the fifth English edition, has been translated in accordance with the tenth German edition. It has been thoroughly revised, and extensive additions have been made throughout the work.

It is unnecessary for us to say anything about such a well-known text-book as Stöhr's "Histology"; let it suffice to say that the present edition, while preserving the former plan of the work, has been thoroughly brought up to date.

The book commences with an excellent résumé of laboratory instruments and technique. In addition, there is at the close of the description of the histology of each tissue or organ a short account of how such a tissue may best be obtained, and how microscopic specimens should be stained and mounted.

The illustrations are clear and distinct, and do not lose in being somewhat diagrammatic.

Health and Disease in Relation to Marriage and the Married State. Edited by PROF. H. SENATOR and DR. S. KAMINER. Translated from the German by J. DULBERG, M.D., of Manchester, England. Vol. I.; pp., 498. Rebman, Limited.

THIS is a translation from the German, and consists of two volumes, of which the first only is now under review; the second is to be published soon. This volume contains articles on such subjects as "The Hygiene of Marriage," "Sexual Hygiene," and "Menstruation, Pregnancy, Childbed, and Lactation," followed by sections dealing with the effects of marriage on the diseases of the various systems. If any excuse for its appearance were required, it would be amply provided by the introduction, but probably no thoughtful medical man will deny that such a work is called for. This work has the advantage over some others we have seen on preventive medicine—for that really is its object—in that it is essentially practical and gives quite definite instructions. Throughout we find it to be sound and accurate, and are particularly impressed by the articles on "The Hygiene of "Marriage," and "Inherited and Congenital Diseases." Certainly some subjects, not usually broached in this country, are dealt with; we are, however, of opinion that harm has resulted from ignoring them in the past. The translator has aimed at a literal translation; some of the expressions and sentences are, in consequence, cumbrous; the meaning is, however, clearly conveyed, except that, on page 9 and elsewhere, we think "hygienic precautions" would be a better

English equivalent than "sanitary precautions." The German work is really a compilation by some thirteen authorities, and has the almost inevitable disadvantage of involving repetitions. We cannot help thinking that the subject matter of real importance might have been compressed into half the space, thus requiring only one volume for the whole. The article on "Consanguinity," which merely accentuates the views now generally accepted, might have been curtailed, while the first of the two articles on "The Influence of Climate" has little relation to marriage. The proof-readers cannot be congratulated; at the beginning we find a fly-leaf with a long list of errata; yet there is no mention here of "widowers" in a table relating to the female sex on page 19, nor of "cause" instead of "course" on page 191.

In spite of its shortcomings, we consider this a useful book on an important subject, and hope it will have the circulation it deserves among the medical profession, especially among those engaged in family practice.

A Guide to General Anæsthetics for the Student and General Practitioner. By THOMAS D. LUKE, M.B., F.R.C.S.E. William Green and Sons.

THIS second edition of Dr. Luke's book has been almost wholly re-written and re-cast, and thereby greatly improved. The art of the anæsthetist is fully set forth, and the book abounds with valuable hints. The illustrations are many and helpful. The author thinks well of ethyl chloride, which, as a general anæsthetic, has almost completely, he says, displaced nitrous oxide in general surgery, although it will probably continue to be employed in dentistry. There is a useful chapter on anæsthetic apparatus in general practice, including paragraphs on "mechanical" anæsthesia, or "How the Practitioner can best work Single-handed." In this last case the author recommends that either the patient be "charged up" with ether or that a Krohne's regulating ether be used with chloroform. In severe smashes and head injuries, the use of morphia and brandy will often do away

with any need for chloroform or ether. Luke believes that to the practitioner not thoroughly accustomed to anæsthetics the mixture of ether two parts and chloroform one part presents many advantages. Excluding the very worst alcoholics, there is practically no type of patient in whom a very good anæsthesia cannot be induced and maintained by it. With this view we heartily agree, and would merely suggest that when the mixture is given by one of the semi-open inhalers, a little ether should be occasionally added to the mixture, which, by the way, should always be freshly prepared. The book contains excellent chapters on local anæsthesia and anæsthetic commissions. An appendix on the Vernon Harcourt chloroform regulator brings the information quite up to date. We can strongly recommend the guide to those students and general practitioners who wish to study the subject of anæsthesia.

The Student's Hand-book of Surgical Operations. By SIR FREDERICK TREVES. New edition, revised by the author, and JONATHAN HUTCHINSON, JUN. Pages, 486; illustrations, 121; price, 7s. 6d. London: Cassell and Co.

FOR some time we have felt that this popular and well-known little book required revision to bring it up to date. Many old and practically obsolete operations were described, while modern surgical procedures in many cases met with scant notice, or were not referred to at all. Consequently we heartily welcome the appearance of a new and revised edition.

The present issue retains the appearance of the old, and no material alteration has been made in the arrangement. The type is rather larger, and twenty-seven new illustrations have been added, but, in spite of these changes, there is a slight decrease in the number of pages. A description of many operations which were purely dead-house exercises have been omitted. The methods of ligaturing such arteries as the facial, inferior thyroid, vertebral, peroneal, etc.; also Larrey's amputation at the shoulder joint, Le Fort's and Tripier's operations on the foot, are not described. The

operations for ruptured perineum and hysterectomy have also been left out. In place of these omissions, a new chapter on middle-ear operations has been added, and there are considerable additions to the chapters on intestinal anastomosis, hernia, and excision of the breast. Numerous less important changes are noticeable, and the whole work shows evidence of careful revision. The lucidity of the text is enhanced by the inclusion of the new illustrations, which are taken from the author's larger work on Operative Surgery.

The omission of much that was old and obsolete, and the addition of much that is modern and important, will greatly add to the value of the book, and we confidently anticipate a continuation of the success which has attended it in the past. We congratulate the author upon his success in having kept down the size of the book to its former limits, while making these important changes.

Arteria Uterina Ovarica, or The Genital Vascular Circle. Anatomy and Physiology, with their Application in Diagnosis and Surgical Intervention. By BYRON ROBINSON, B.S., M.D., Chicago, Ill. Published by E. H. Colegrove, Chicago, Ill. 1903.

IN the preface, the author states that he presents this monograph to the medical profession in the hope that it will contribute to the progress of medical science. He styles the arterial circle of the arteria uterina ovarica with part of the abdominal aorta, common iliac, and internal iliac, as the "circle of Byron Robinson." He recommends an operation called endometrectomy, with partial myomectomy.

The book is profusely illustrated, containing as many as one hundred and seventeen figures. Very many of these seem to be altogether superfluous, and to represent the same features in anatomy and relations of the utero-ovarian artery. Many of the drawings are taken from the dissections that have been performed by the author; they are diagrammatic, and show the great amount of work that has been spent on their production from the cadaver. The text relating to

the description of the "Circle of Byron Robinson" is, we think, too long, and such as might be more clearly set out in much less space. The term "Circle of Byron Robinson" forms a prominent place in most of the descriptions of the diagrams, and refers to the well-known anastomosis of the uterine and ovarian arteries with their connecting trunk arteries, viz., the abdominal aorta, the common and internal iliac arteries.

The operation of endometrectomy, with partial myomectomy, is recommended as a conservative procedure, but which is stated to be sufficiently radical to arrest the functions of menstruation and pregnancy. The author claims that the ovaries, tubes, broad ligaments, with nerves and vessels, are left intact. The technique consists in freeing the cervix in front and behind, and bisecting the uterus, first from below and afterwards from above (with the fundus brought down through the posterior fornix), and then suturing together the cut edges of the same side. We do not think, however, that such an operation will find any favour, even though it should become known to the profession. Throughout the book the spelling is at fault in many places, as is also the English.

Notes on the Composition of Scientific Papers. By T. Clifford Allbutt, M.A., F.R.S. Pp., 154. London: Macmillan and Co. 1904.

Clearness, conciseness, and elegance are qualities not often met with in the writings of British medical authorities, in whose books the matter is often good, but the manner is poor. The glaring defects in composition so often met with are due far more to carelessness than to ignorance, and this carelessness is to be especially condemned in those numerous instances in which it renders the records of excellent work so wearisome to the reader that much good matter passes unread. Professor Clifford Allbutt's book begins with a chapter on thesis writing. He says that the writer of a thesis "must have made the subject his own; his treatment "of it must bear the characters of personal observation and

"reflection, which raise an essay above the level of ordinary "compilation, and the powers of handling ideas and prin- "ciples, which distinguish, or should distinguish, University "training as contrasted with technical instruction." How difficult it is to observe these rules is probably appreciated by every medical writer, but we shall all write more clearly and accurately if Professor Allbutt's words are deeply impressed on our minds.

We remember once meeting with the sentence, "The radical cure of an inguinal hernia is easier than a femoral hernia," in a book by a well-known surgeon, who has fully earned his high surgical reputation, and we quote the sentence simply to show to what an extent an author can be careless in his writing, even when there should be no difficulty in conveying a perfectly clear meaning without making any error in composition. Professor Allbutt gives many examples of this kind. His instructions are clear, his advice is sound, and his book is so admirably written that we feel that in the future we shall have no excuse for repeating those blunders as regards composition which we have doubtless many times committed in the past. We recommend this book to every medical man who wishes to possess the power of putting his thoughts into accurate, plain, and simple language.

The Pathology of the Eye. Vol. I., Part I. By J. Herbert Parsons, B.S., D.Sc. (Lond.), F.R.C.S. (Eng.). London: Hodder and Stoughton. 1904.

It is rather surprising that up to the present no complete monograph on the pathology of the eye has been written in any language. Mr. Parsons has set himself the tremendous task of supplying this deficiency. The work will appear in four volumes, the first two dealing with the pathological histology of the several structures of the eye and its annexes, and the last two with diseases which affect the eye as a whole, *e.g.*, glaucoma, sympathetic ophthalmia, congenital malformations, etc. The volume before us includes the

pathological histology of the lids, conjunctiva, cornea, sclerotic iris, anterior chamber and ciliary body, together with the bacteriology of the conjunctiva. Each section is preceded by a short and lucid account of the histology of the part.

The descriptions of the various pathological processes are clear and exhaustive. The bibliographies at the end of each subject—the compilation of which must have added enormously to the labours of the author—render the book invaluable as a work of reference. The author has spared no effort in reviewing all literature of value on every subject. Some of the chapters—*e.g.*, the pathology and bacteriology of trachoma, and arcus senilis—are of the nature of short monographs, in which the views of all modern writers on the subjects are compared and reviewed. One of the most valuable chapters in the volume is that on the bacteriology of the conjunctiva in health and disease, and it represents very accurately the present state of our knowledge of that subject. The only conjunctival subject which seems to have escaped the author's attention is the pathological histology of the condition known as Parinaud's Conjunctivitis, which should certainly have been included in a standard work of this sort.

All the other sections of this volume are remarkably complete and exhaustive, and compare favourably with anything that has been written in any branch of pathology.

The illustrations are profuse, and on the whole are well executed. They are half-tone reproductions from photographs which have not been touched up in any way. This method of illustrating has been adopted because the author regards "fidelity as of prime importance in an advanced work of this kind, and when a good knowledge of normal and general pathology is taken for granted." Even allowing for some loss of detail in the reproductions by half-tone blocks, we think that some of them might easily be improved upon.

Taking the volume as a whole, it is of exceptional merit, and we consider that the author has fully attained his object of giving (as far as the structures included are concerned) "as

complete an account of the pathology of the eye as is possible in the present state of our knowledge."

The publishers' part of the work has been admirably done, and we congratulate them on the success of their venture into medical publications.

Manual of Practical Ophthalmology. By GEORGE A. BERRY, M.B., F.R.C.S. (Edin.). Edinburgh and London: Young J. Pentland. 1904.

THIS book is one of the well-known Pentland's Students' Manuals, and it fully maintains the high standard of excellence which characterises that series. It is written in a delightfully readable style, which should make the study of ophthalmology a pleasure to the student.

The work is not supposed to be an exhaustive treatise on ophthalmology, but the information given is thoroughly sound and ample for the student's purpose. The outstanding feature of the work is an honest endeavour to explain the "reason why" of all processes and methods of treatment. This, and the absence of the usual tabulations, make it the very antithesis of the cram-book.

The book is divided into two sections. Section I. includes general remarks on eye operations, methods of examination of the eye, diseases of the various structures of the eye and its appendages, intracranial tumours, foreign bodies in the eye, amblyopia, and other anomalies of vision.

Section II. is devoted to errors of refraction and accommodation, and affections of the oculomotor muscles.

The work is well illustrated throughout, many of the figures being familiar to us as reproductions from the author's larger work.

The whole work shows evidence of careful clinical observation and judicious sifting of recent ophthalmic literature. The treatment of the more common diseases of the eye is fully given, and the prescriptions interspersed throughout the text will be found useful by those who are not in the habit of prescribing for eye cases every day.

In the chapter on "Foreign Bodies in the Eye," the diagnostic and localising value of X-rays might have been more prominently pointed out, and instructions in the use of the hand and giant magnets more fully given. We think that the author's prognosis of retained foreign bodies in the globe is somewhat too optimistic, and we question the soundness of his practice of leaving small pieces of steel or iron in the anterior chamber, as long as they do not give rise to marked reaction. Section II., though admirable from an ophthalmic surgeon's point of view, is too advanced to be thoroughly appreciated by the average medical student. The author considers the subjective method of testing for ametropia to be the most rapid and accurate. Our experience is that, in young people at any rate, both rapidity and accuracy are gained by the estimation of the refraction by retinoscopy, under drops, before proceeding to the subjective test.

The mode of production of convergent squint is well described, but we think that the association between accommodation and convergence is unnecessarily elaborated for a students' text-book. The author is not greatly enamoured of the orthoptic treatment of squint, and questions if cases treated by this method do any better than they would have done without it. He also discredits the possibility of the production of purely muscular asthenopia. His views on this subject are worthy of the serious consideration of ophthalmic surgeons.

We congratulate Mr. Berry on the production of an admirable students' text-book which is thoroughly reliable, and in many respects a distinct advance on the ordinary text-book.

ABSTRACTS.

THE SURGICAL TREATMENT OF CIRRHOSIS OF THE LIVER.

AT the French Surgical Congress, held in October, 1904, one of the chief subjects of discussion was that of the surgical treatment of cirrhosis of the liver. A full report of the discussion, which was introduced by Monprofit, is given in the *Revue de Chirurgie* for November, 1904. According to the various speakers, surgical treatment for cirrhosis of the liver may take the form of :—

1. Paracentesis.
2. Laparotomy, followed by drainage of the peritoneal cavity.
3. Cholecystostomy.
4. Omentopexy, or Talma's operation.

Omentopexy seems to be the operation most generally made use of in France, and Monprofit gave the opinion that it is a comparatively safe operation, considering the gravity of the condition for the relief of which it is performed, and that its therapeutical results are good. He stated—and all the other speakers seemed to agree with him—that it is far more successful in cases of hypertrophic than of atrophic cirrhosis, and he called attention, too, to the fact that hypertrophic cirrhosis is much more amenable to ordinary medical treatment than is the atrophic variety. According to Monprofit, the operation results in cure of the ascites in 70 per cent. of cases of hypertrophic cirrhosis, and in 35 per cent. of cases of atrophic cirrhosis. But this favourable opinion was not shared by other speakers Thus Willems said that he had done omentopexy in four cases of hepatic cirrhosis, with the result that one patient died, and in the three others the ascites re-appeared. As opposed to the figures given by Monprofit, he quoted the German statistics, which give only

ten really favourable results in two hundred and fifty cases. Again Lejars stated that he had performed this operation three times, with a fatal result in each case. More favourable results, however, had attended the practice of Schwartz and of Bardesco, the former of whom had operated on five patients suffering from atrophic cirrhosis with ascites, with the result that two of the patients died, while in the other three instances a marked improvement took place. Bardesco has operated eight times, with the following results :—Two patients died very soon after operation; one died three months after operation; in one case the ultimate result was unknown; while four of the patients were well and without any return of ascites at intervals, respectively, of twenty-eight, twenty-three, sixteen, and fifteen months after operation. As regards the indications for operation, opinions seemed to differ, but the general opinion was that the patient should be operated on when still in fair condition, and that the best time for operation is either as soon as ascites appears or as soon as it re-appears after the first tapping. Monprofit remarked that, on opening the abdomen, it is sometimes found impossible to go on with the operation owing to the puckering up of the omentum. At other times the omentum is found to be adherent to the anterior parietal peritoneum, and very large blood-vessels may be present in the adhesions, the operation thus appearing to have a correct physiological basis.

Bardesco described his method of performing omentopexy :—The abdomen is first tapped, and as much as possible of the ascitic fluid drawn off. An incision is then made from the xiphoid cartilage to the umbilicus, and the remainder of the fluid is mopped out. Next, at a distance of two fingers' breadth from each border of the wound, a vertical incision, eight to ten centimetres long, is made on the internal aspect of the abdominal wall, the lower ends of the incision being on a level with the umbilicus. These incisions go through to the anterior surface of the recti muscles, and through them the finger is passed, and the tissues stripped off the anterior surfaces of the recti. A piece of

omentum is next passed through each incision into the pocket on the front of the rectus muscle, the omentum being stitched to the edge of the incision by means of interrupted catgut sutures.

Some of the speakers gave their experience of other operations in cases of cirrhosis. Thus, Jayle considers that in cases of cirrhosis with ascites, the abdomen should be tapped, and, if the fluid re-accumulates, laparotomy should be done. He quoted the case of a man from whom he drew a large quantity of ascitic fluid by tapping, and in whom the ascites never re-appeared. Again, Delagénierè found that temporary cholecystostomy gave excellent results in cases of hypertrophic cirrhosis, but that it was of no use in cases of atrophic cirrhosis. His favourable opinion of this treatment in the former class of cases was founded on an experience of six cases.

LEONARD GAMGEE.

WAXY DEGENERATION.

THE nature of amyloid degeneration, the causes which go to produce it, and the method of its production, have always been among the puzzles of pathology. Our knowledge with regard to waxy disease is very little further advanced than it was fifty years ago. It was long ago recognised that the tissues affected with this condition gave certain chemical reactions, that they had a certain chemical composition, and that they were associated with certain pathological processes. Very little more is known at the present time.

At the recent meeting of the German Pathological Society, the whole subject of amyloid disease, its nature, origin, and relationships, was considered, and some new light was thrown upon all these questions. Before discussing these, the most recent pronouncements of scientific medicine on the question, however, it would be well to give a summary of what was known up to a recent date.

As regards what was included under the term waxy or amyloid, three reactions are taken as indicative of the disease. As a matter of fact, as will be seen later on, the three are not always given by a particular diseased tissue; still, when all three are present, the nature of the condition does not admit of doubt.

The first reaction is the mahogany-brown colour produced in waxy tissue when treated with a solution of iodine. If to this be added a weak solution of sulphuric acid, the brown colour changes to dark violet or black. This second reaction suggested to Virchow that the substance was of the nature of cellulose, hence the name amyloid. The third reaction is given by a number of aniline dyes; methyl-violet and iodine-violet give a ruby-red colour; iodine-green and methyl-green give a reddish-violet tint.

As regards the chemical nature of the substance, for long little was known, owing to the extreme difficulty of separating the amyloid material in a pure state. That is, however, now possible, and it may be done in the following way. An impure amyloid is obtained by treating waxy tissue with ammonia, and then by precipitating with an acid; this is treated with baryta water, which dissolves the amyloid alone; subsequent treatment with hydrochloric acid precipitates the substance in a pure form as a powder, easily soluble in alkalies, with difficulty in acids. Its composition is, roughly, as follows:—C. 49 per cent., H. 7 per cent., N. 14 per cent., S. 2.8 per cent. It was soon found that the amyloid material was not a simple substance. The presence of chondroitin sulphuric acid as a constituent of organs showing waxy change was discovered by Oddi. The formula for chondroitin sulphuric or sulphonic acid is given by Schmiedeberg as C_{18}, H_{27}, $N.S.O_{17}$. It decomposes into chondroitin (a monobasic acid) and sulphuric acid. Subsequently Krawkow proved that the chondroitin sulphuric acid was firmly combined with an albuminous body. This chondroitin sulphuric acid group occurs normally in cartilage and in elastic tissue. An almost identical body to true amyloid has been discovered by Krawkow in the normal aorta.

Amyloid degeneration is a change which affects particularly connective tissue, especially the walls of vessels. It appears first in the media, and shows itself as masses of hyaline material between the muscle fibres; these increase in size and unite together, forming ring-like masses which compress and ultimately destroy the muscular substance. On the other hand, the endothelium remains intact for a long period. The waxy change also appears very frequently in the connective tissue of liver and spleen in kidney and lymph gland, also in the suprarenal, the intestinal villi, in stomach, uterus, and heart. Waxy degeneration has never been observed in the epidermis, in the glands of the skin, in the lung, bones, and nerve tissue. It may also be observed in tumour formations, particularly those which occur in connection with the respiratory passages and the eyelids.

With regard to the causation of the condition, little can be said. We know that it tends to occur in certain pathological conditions, in cases of prolonged suppuration, in tubercle, and in syphilis. In how far the two last are included under the first, it is impossible to say. Following the suggestion afforded by these facts, Birch-Hirschfeld, Czerny, Krawkow, and many other observers have endeavoured to produce the condition artificially by the injection of cultures of staphylococci, pus, etc., into animals. A degree of success has crowned these efforts, but the amyloid produced varies somewhat in its characters and chemical reactions.

Lastly, with regard to the theories as to the mode of formation, we have three possibilities. First, that it is a substance secreted by the cells; second, that it is a direct transformation of the fibres of the tissue; and third, that it is derived from a substance in the blood which either diffuses out and becomes deposited in the tissue spaces, or which unites with some structure already present to form the amyloid tissue material. It has been suggested that the substance carried by the blood is the chondroitin-sulphuric acid which is brought to the diseased organs and, uniting with an albuminous body, is deposited as amyloid. Attempts to

prove this experimentally by the introduction of large quantities of chondroitin-sulphuric acid have, however, hitherto failed entirely.

Turning to the recent work on the subject (Schmidt, Neuberg, Davidsohn, etc., *Verhand. der deutsch. path. Gesellsch.*, 1904, H 1), one may divide the results under the above-mentioned headings.

As regards the staining reactions, Schmidt considers that the results of animal experiments should not be neglected on account of a difference in the appearance and in the staining reaction between amyloid as it occurs in the human subject and amyloid produced experimentally. The variation appears to depend largely upon the duration of the experiments. The first reaction to appear is the pink colour with methyl-violet; then the iodine sulphuric acid test is given, but it varies from red-brown through green to violet and blue, the blue colour representing the highest stage of development in the waxy substance.

He further points out that even in the case of human disease there are variations in the reactions, particularly in the case of iodine and iodine-sulphuric acid tests. Sometimes the iodine by itself stains the amyloid blue or blue-green. In another set of cases the classical reaction of Virchow is absent, and the sulphuric acid does not change the iodine blue, but at most green. There are also differences in the different organs. The blue colour with iodine-sulphuric acid is almost entirely restricted to the spleen. Sometimes a part of the diseased organ is refractory towards iodine, while the methyl-violet reaction is successful everywhere.

All these facts correspond with the idea that amyloid substance is of different ages in different places; also that retrograde changes occur, with consequent alterations in staining reaction.

The above changes in amyloid material can be artificially induced by placing pieces of the diseased organs in the abdominal cavity of animals. In this way tissue has been changed so that while it preserved the methyl-violet reaction, iodine ceased to colour it.

The point now arises: Which constituent of the amyloid substance is the one which reacts to these chemical substances? According to Krawkow, it is the chondroitin-sulphuric acid portion which gives the characteristic chemical tests. According to Oddi, the above constituent can be removed without influencing the appearance of the substance, although the chemical reactions are no longer given. This is supported by a fact observed by Schmiedeberg that the removal of the chondroitin-sulphuric acid from cartilage left it unchanged in appearance and in other physical properties.

This brings us to the relationship between amyloid and hyalin, and suggests that the latter is simply the former without the chondroitin-sulphuric acid. One cannot, however, say that every hyalin substance is nearly related to amyloid, and is capable of transformation into the latter on the absorption of a stainable substance. The hyalin of epithelial origin, such as the thyroid secretion or the kidney casts, are excluded. The above relationship is supported by the fact that one may observe transition stages between amyloid which gives characteristic reactions and amyloid which is apparently simply hyaline; the two may be observed, in other words, side by side. There is, however, no actual proof that hyaline passes into amyloid. All that has been proved is that hyaline and amyloid arise together under similar conditions, and that amyloid, by loss of staining reaction, can become a substance indistinguishable from hyaline. In all probability, the union of the chondroitin-sulphuric acid with the hyaline substance occurs *in statu nascendi* of the latter, and not by a binding of the acid to an already-formed hyaline.

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As previously stated, chondroitin-sulphuric acid is found in normal cartilage and in elastic tissue. A connection between this fact and the occurrence of amyloid disease is difficult to trace. The disease certainly occurs in arteries and arterioles, but it also occurs in capillaries where there is no elastic lamina. As regards the local production of amyloid, one finds that the facts are more in line with the idea

of the derivation of the colourable constituent from normal cartilage, as these tumours chiefly occur in the eyelid and in the respiratory passages.

It has been suggested that the occurrence of amyloid disease in the smaller arteries was an argument for the theory that the substance was a transudate from the blood. But, after all, the small arteries do not allow the passage of blood through their walls, and the disease is not restricted to the small arteries and capillaries, but occurs in the largest arteries and in the veins.

Schmidt considers that there is no evidence for the production of amyloid from epithelial cells. Appearances suggesting this may sometimes be seen, but they are to be explained by the absorption of amyloid substance by damaged or dead cells.

As regards the position in which amyloid is first seen, Wichman's investigations on blood-vessels seem to show that the amyloid substance only appears in the interstices of tissue, and that neither cells nor fibres are directly affected. Schmidt has found amyloid in a non-vascular part, such as the heart-valves, giving a network appearance corresponding to the lymphatics of the part, and he considers that amyloid is thrown out into the serous spaces of the connective tissue, and that it may reach the lymph-vessels themselves.

It may be assumed that amyloid at the moment of origin is a stiff material which is never subsequently removed. It never occurs metastatically.

Turning to the more recent work on the experimental production of waxy disease, we find that Davidsohn, out of one hundred attempts to produce amyloid in animals by injecting staphylococcus aureus, was successful in about one-third. He had previously noted, when experimenting with a variety of organisms, that the spleen was the organ most frequently affected with the disease, and he had obtained the impression that it began in that organ. In this later series of experiments, he found that in all the positive results the spleen was affected. In order to establish a positive result, he considers it necessary to obtain all three characteristic reactions.

In order to investigate more closely the connection between the spleen and amyloid disease, he carried out a further series of experiments. In the case of one set of animals, he excised the spleen; then he attempted to induce amyloid disease by the injection of cultures of staphylococci; not one of these animals developed a trace of waxy disease. As controlls, he inoculated a series of animals with the same cultures without excising the spleen, and he found that, as before, about one-third of the number developed amyloid. Davidsohn further found that the filtered cultures had no power to produce the disease. He was able, however, to induce it by the injection of cultures of the gonococcus. As regards the question as to why the spleen should be specially concerned in the production of amyloid, Davidsohn suggests that, *e.g.*, in chronic suppuration we have a great destruction of cells, particularly of leucocytes, and as the spleen is the organ where these products of destruction are filtered from the blood, it is from these retained products in the spleen that the albumen body of amyloid substance is developed.

Schmidt concludes as follows with regard to the production of amyloid:—Amyloid substance cannot be demonstrated in blood, in clots, or in ante-mortem thrombi. It cannot be pre-formed in the blood, only showing its characteristic properties on passage through the vessel wall, because inflammatory exudates on serous surfaces are free from it. An argument in favour of the participation of transudation in the process is the affection of the connective tissue scaffolding of such organs as the kidney only in connection with blood-vessels. In favour of the participation of the tissue in the process is the fact that the condition only occurs in connection with certain tissues, viz., nonstriped muscle and connective tissue. He considers that there are three factors working together in the formation of amyloid—(1) an albuminous body; (2) chondroitin-sulphuric acid; (3) a ferment. Where these various constituents come from is entirely a matter of conjecture. As we have seen, Davidsohn considers that the albuminous body is furnished by the spleen; the chondroitin-sulphuric acid is probably derived from cartilage or elastic tissue. It is therefore probable that we have

here to do with a pathological synthesis of substances normally present, so that only the ferment is to be regarded as pathological. The most probable suggestion is that the albuminous component comes from the blood, possibly manufactured in the spleen; it is transuded into the tissue spaces, and is here precipitated in certain tissues as a solid substance by a ferment developed in these tissues, this substance having the property of fixing *in statu nascendi* chondroitin-sulphuric acid.

JAMES MILLER.

REPORTS OF CASES.

A CASE OF ACUTE HÆMORRHAGIC PANCREATITIS.

By George Heaton, M.A., M.B., F.R.C.S.

C. L., a fitter, aged forty-eight years, was seen by me, in consultation with Dr. Brash, on October 17, with symptoms of apparent acute intestinal obstruction. His clinical history was as follows :—He was apparently quite well until October 15, when in the middle of the night he was suddenly seized with acute pain in the pit of the stomach. The pain was constant, that is to say, always present, but every now and then he had paroxysms of agony. He vomited a few hours after the onset of the pain, and this vomiting was occasionally repeated. The bowels were open before the attack began, but were not afterwards. The temperature at this time was slightly raised—99.5°; the pulse, 88. There was no jaundice and no cyanosis. The pain remained most acute all the next day, and the abdomen rapidly became distended. The vomiting ceased, and a large purgative enema brought away a little fæcal matter.

Previous History.—He was always a somewhat stout man, and had been at times a heavy drinker. There was no previous history of jaundice, or attacks of gallstone colic.

On Examination.—He lay on his back, with his knees slightly drawn up. The abdomen was very much distended and tympanitic in front; there was some shifting dulness in the right flank. The abdomen was tender all over, but his pain, at times excruciating in character, was situated chiefly in the epigastrium and the right hypochondrium. His temperature was 100°, and his pulse 120, small. The eyes were somewhat sunken. There was no jaundice. The tongue was furred and inclined to be dry. He felt sick, but did not actually vomit. The rectum was empty, and a

simple enema was returned without result. The case was thought to be one either of acute internal strangulation of the intestines, perforation of some hollow viscus, or acute pancreatitis.

He was anæsthetised, and a median abdominal section made. On opening the abdominal cavity, a large quantity of mixed blood and ascitic fluid escaped. The quantity was not measured, but was roughly estimated at about two pints. The fluid was chiefly in Douglas's pouch and in the right hypochondrium, under the liver. The intestines were somewhat congested, and the vessels injected, and in many places showed dark patches on their walls, as if hæmorrhage had taken place into them.

There was no evident obstruction, and, though no areas of fat necrosis in the omentum were visible, a diagnosis of probable acute pancreatitis was made, and the pancreas examined. By bringing several coils of small intestine and the omentum outside the abdomen, it was possible to inspect the pancreas. It was found to be very much swollen, softened, and to have scattered on its surface black hæmorrhagic areas. Nothing more was done except to drain the pancreatic area and Douglas's pouch, and the rest of the abdominal wound was closed.

He bore the operation well, and had a comfortable night. There was no more sickness, and two good actions of the bowels followed the administration of a purgative enema.

On mid-day of October 18, his pulse began to fail, and the abdomen to become distended, and he gradually became worse all that day. At 2 p.m. on October 19 he suddenly vomited fifty ounces of dark bloody fluid, and died in a few minutes. A *post mortem* examination was made on the following day.

The body was well developed and rather fat. No jaundice.

Heart normal. Atheroma of aorta.

Lungs.—Adhesions at left apex.

Peritoneum contained three ounces of blood-stained fluid. There were many small spots of fat necrosis in the mesentery and in the sub-peritoneal gut in the anterior abdominal wall.

There were masses of fat necrosis, about the size of a hazel nut, in the gut around the pancreas and at the root of the mesentery, also a little in the great omentum.

Stomach greatly distended with gas.

Liver.—Normal. The gall-bladder was considerably distended with bile, but a probe could be easily passed from the opening of the common bile and pancreatic ducts in the duodenum along the bile-duct into the gall-bladder.

The *Pancreas* was greatly swollen and hard, being over two inches in thickness. There were hæmorrhages on its surface. On section, there was a considerable amount of hæmorrhage into its substance, especially in the region about the junction of the head with the body. There were opaque yellow patches, which were the result of necrosis of the adipose tissue of the organ. The glandular substance appeared swollen, and was reddish-purple in colour. There was no thrombosis of the veins. The duct of Wirsung could not be found. There was a considerable amount of fat-necrosis round the head of the pancreas.

Other organs.—Normal.

Microscopic Examination.—

(1) *Pancreas.* In small areas the pancreas appears quite normal, while in other areas the glandular substance shows marked cloudy swelling. In no place is there gangrene. There are acute inflammatory changes in the interstitial tissue of the organ. Numerous small hæmorrhages are seen. No micro-organisms can be demonstrated.

(2) *Areas of Fat-Necrosis.*—The adipose tissue is simply replaced by a granular material which stains well with hæmatoxylin. It is not dissolved out with alcohol and ether, and is therefore not likely to be an alkali soap. The substance is not decomposed with HCl (at least, it could not be decomposed in the sections after they were cut), and this is rather against the theory that it is a calcium soap.

Remarks.

Cases of acute pancreatitis are of great interest, both to the pathologist and to the clinical physician and surgeon.

To the pathologist they present problems at present only partially understood; for the essential causes of the disease, the nature of the resulting fat-necrosis, and the reasons for the hæmorrhagic tendency displayed in the disease, are all at present imperfectly understood.

To the clinical physician and surgeon they are of extreme interest on account of their extreme fatality and the difficulties surrounding their diagnosis. The main symptoms of the disease are almost indistinguishable from those of acute intestinal obstruction, and in nearly all the recorded instances the case has been treated as such until, either on the operating table or in the *post mortem* room, the true nature has been discovered.

The case recorded above presented some of the typical characteristics of the malady. The patient had been a heavy drinker, was a man of middle age, and was stout. The pain was agonising in character, and was chiefly above the umbilicus. There was marked constipation, but it was not absolute. The hæmorrhagic tendency was well exemplified by the large quantity of bloody fluid found in the abdomen at the operation, and the large hæmorrhages into the pancreas itself, and by the copious vomiting of blood which took place immediately before death.

There was, on the other hand, no jaundice, and no history of previous gall-stone trouble, nor was cyanosis (which has been by some authorities described as almost always present) ever observable.

Operation seems in the most acute cases to be quite powerless to avert the fatal issue. But in the less acute cases, where abscess afterwards forms, or sloughing of the pancreas takes place, drainage of the pancreatic area, either from the front or from behind, has been followed by recovery.

REPORTS OF SOCIETIES.

BRITISH MEDICAL ASSOCIATION.

BIRMINGHAM BRANCH.

THE fourth ordinary meeting of the Branch was held on Thursday evening, January 12, at the Medical Institute, at 3.30 p.m. The President, Dr. T. E. Underhill, was in the chair, and there were twenty-seven members present.

The minutes of the last meeting were read, confirmed, and signed.

Aneurysm of the Aorta Rupturing into the Trachea.—Dr. Short showed the aorta, heart, and trachea of a man aged thirty-five, who died suddenly from the rupture of an aortic aneurysm. During the few days that he was under observation, there was no other sign or symptom beyond the characteristic ringing cough. There was no tumour, murmur, pain, dyspnœa, or sign of intrathoracic pressure, and the pupils, pulses, and vocal cords gave no indication. He was regularly at work until the cough caused him to seek advice. The aneurysmal sac was only about as large as a Barcelona nut, and communicated by means of a small opening with the trachea. Death was instantaneous.

Specimen of a Supernumerary Auricle.—Dr. Glegg showed a supernumerary auricle which he had removed from the skin in front of the right tragus of a girl aged twelve years.

Mr. F. Faulder White read a paper "On the Value of Otectomy in the Treatment of Suppurative and Non-Suppurative Diseases of the Ear," under the following headings :—

Suppurative Otitis tends to persist, its dangers. Teach- and treatment too often inadequate.

A description of Otectomy, its safety, an important aid to disinfection by irrigation. Compared with the radical operation.

Good hearing possible in the absence of the drum.

Otectomy as a remedy for catarrhal deafness.

The paper was discussed by the President, Drs. Lamb, Glegg, Sydenham, Melson, and Mr. Morrison; and Mr. White then replied.

Dr. John Duncan then read a paper entitled "Involution of the Uterus after Labour, as shown by External Examination of the Fundus Uteri. Data from seventy cases," of which the following is an abstract:—

(*a*) Relation of fundus uteri to umbilicus. Averages. Charts. Daily excursions of fundus. Time of vanishing of Fundus.

(*b*) Relation of Fundus to Syhphysis Pubis.

(*c*) Relation of Umbilicus to Symphysis.

(*d*) Lateral Deviation of Fundus. Occipito-Posterior Cases.

(*e*) Antero-Posterior Variations.

Dr. Purslow and Mr. Morrison spoke to the paper, and Dr. Duncan replied.

KIDDERMINSTER MEDICAL SOCIETY.

A MEETING of this Society was held on December 8, Mr. C. D. Fitch, President, in the chair.

Mr. J. Lionel Stretton showed several cases of specimens, amongst which were the following:—(1) A woman, aged thirty years, from whom he had removed a malignant stricture of the sigmoid. The portion of intestine removed was about five inches long; the junction was made by simple suture. She made a perfect recovery, and was discharged in three weeks. She now suffers no discomfort. (2) A cæcum and appendix, with about one foot of ileum, removed from a woman, aged fifty-one years. There had evidently been an intususception some years previously, and the portion of intestine involved had become malignant. The calibre of the gut was not more than one-eighth inch; the junction was made with catgut sutures. (3) A woman, aged seventy-five years, on whom he had operated for double cataract, *at one sitting*, with satisfactory result.

He had had fifteen cases of appendicitis under his care within two months, and four on one day. Of these cases, twelve had been operated on, and three refused. All operated on recovered, though one seemed hopeless, and another was exceedingly ill.

Four more cases had special points of interest. Mrs. H., aged fifty-eight years, admitted with a history of fourteen days' constipation, following sudden pain in right iliac region, when a globular mass about the size of a cricket ball could be felt. Symptoms did not indicate appendical trouble, but an exploratory incision disclosed a large abscess behind cæcum; the discharge became fœcal in two days, and had now nearly ceased. A boy aged seven years, admitted with history of attack of appendicitis previous week. Appendix found curled up with tip adherent near base; about half an inch from tip it was closely adherent to omentum, and on separating this a small abscess was discovered containing half a drachm of pus, connected with the interior of the appendix through a slough opening. Appendix removed; uninterrupted progress; no temperature. A fortnight later a lump appeared below the right costal margin, which proved to be a large subphrenic abscess. A man, aged thirty-five years; two attacks, last about a week ago; had fully recovered, and was able to walk from station to hospital, a distance of about one and a half miles; temperature subnormal; no symptoms; yet on operating, an abscess was opened containing an ounce of pus, and the appendix was so rotten that it tore in two. A woman, aged thirty-eight years, had, in addition to appendicitis, seventy-nine gall-stones. Both conditions diagnosed before, and both removed at time of operation.

Mr. Stretton also showed phosphatic vesical calculus, weighing 222 grains; prostate gland, weighing three ounces, together with a small mulberry calculus removed from a man aged seventy-five; forty-five gall-stones from woman aged sixty-seven; seventy-five gall-stones from woman aged thirty-eight; large gall-stone, weighing 145 grains, from a woman aged fifty-four.

Dr. Evans showed a boy, aged six months, on whom he had operated for radical cure of umbilical hernia with satisfactory results.

Dr. B. Addenbrooke showed a uterus, containing a sloughing fibroid, which he had removed per abdomen. The patient, who had had backache and offensive discharge for five years, was making a good recovery from the operation.

BOOKS RECEIVED.

From Felix Alcan, 108, Boulevard St. Germain—

Précis de Chimie Physiologique. By ALLYRE CHAUSSEVANT.

Les Nerfs du Cœur. By E. de CYON.

From John Wright, Bristol—

Meals Medical. By W. E. FERNIE, M.D.

From Young J. Pentland, London and Edinburgh—

Edinburgh Medical Journal. Vol. XVI.

From "The Medical Times," 11, Adam Street, London—

The Chief Operations of Ophthalmic Surgery.

MEDICAL PREPARATIONS.

HYDROZONE AND GLYCOZONE.

We have received samples of these preparations, prepared by Charles Marchand, and have tried their effects in cases where a reliable antiseptic or cleansing agent is required.

Hydrozone is a preparation of hydrogen-peroxide containing a larger proportion of oxygen than any other with which we are acquainted. It is, in consequence, an unusually powerful oxydising agent, yielding thirty times its own volume of nacent oxygen. It may be used in all cases of foul ulcers, septic conditions of the mouth and nasal passages, septic cystitis and malignant growths in process of breathing down.

Glycozone is a similar preparation, combined with glycerine. It is more stable, and, therefore, easier of application. Glycozone acts more slowly than hydrozone, and may therefore be used as a dressing in all cases of septic and sloughing character. Internally, glycozone is of use in cases of gastric stasis, and in one case we obtained very satisfactory results. It is easy and pleasant to take. We are more attracted to the latter of these two preparations, for we find hydrozone more difficult to keep. We feel confident that both will prove admirable disinfectants, and we trust many of our readers may be induced to use them.

ERRATUM.

MEDICAL PREPARATIONS.

In the October issue (p. 629)—Milo Food for Infants was inadvertently described as Nestle's Milk Food for Infants.

ON PARTIAL AND COMPLETE EXCISION OF THE TONGUE.

By Jordan Lloyd, M.Sc., M.S., M.D., F.R.C.S., *Professor of Operative Surgery in the University of Birmingham.*

At the risk of being dull, but in the hope of laying before you some facts of practical value, I am venturing to take up the time of the members of this society by a paper on operations for the partial and complete removal of the tongue. In my house-surgeon days, I remember well the excitement which prevailed in a hospital when an operation for complete removal of a tongue was about to be performed. The proceeding was regarded as of much more than ordinary interest, and every resident officer and every member of the surgical staff made a point of being present in the operating theatre on the occasion. The most elaborate preparations for dealing with shock and hæmorrhage were made; the arrangements for light were scientifically planned; a formidable array of complicated and generally useless weapons—brilliant in their glittering newness—were set out on tables near at hand; and ligatures of whipcord thickness, carefully tested in their tensile strain; forceps with jaws as powerful as a crocodile's; cauteries and caustics of hæmostatic repute, were conspicuously placed so that they might be handed to the surgeon in the "flash of a second." Several methods of excision were then in vogue; and ecraseurs—galvanic and non-galvanic—were requisitioned at most operations. The whole proceeding was carried through in an atmosphere of excitement, for the dread of hæmorrhage from so vascular an organ was great and general. Operations—in the early seventies—were almost always performed through the mouth, although many years prior to this period Syme, Roux, Laugenbeck, and Billroth had devised procedures in which the lower jaw was divided, and Regnoli had published his infra-maxillary method. Intrabuccal operations practically

held the field until 1880, when Kocher introduced a method of opening the mouth from behind and below the angle and body of the lower jaw to reach the base of the tongue, and remove with it all lymphatic and other structures lying in the sub-maxillary triangle.

The proper understanding and performance of major tongue operations depends so much upon an accurate practical knowledge of the anatomy of the parts that I shall devote a few moments to the subject. The tongue is essentially a muscular organ consisting of two symmetrical halves, apposed to each other in the middle line, connected by interlacing muscle fibres and mucous membrane, and separated only by a rudimentary fibrous septum in the posterior half of the organ. Adjacent to the middle line in each half lies the vertical fan-shaped geniohyoglossus muscle, attached only at its apex in front to the upper genial tubercle of the mandible, and at the angle of junction between the posterior ends of the upper curved and lower straight borders behind to the upper surface of the body of the hyoid bone; the rest of the "fan" being free. On the outer side of this muscle is the lingual artery, outside which lies the square-shaped hyoglossus muscle, whose lowest side is attached to the cornua and body of the hyoid bone, whose uppermost side blends with the other tongue muscles, and whose anterior and posterior borders are free. Lying on the outer side of this muscle is the lingual vein and the hypoglossal nerve. Beneath the anterior half of the tongue, and separating it like a diaphragm from the tissues under the chin, is the mylohyoid muscle, triangular in shape, with its apex forwards—attached by its outer and upper border to the inner surface of the body of the jaw; by its lower or inner border to the hyoid bone, the symphysis of the jaw; and between these points to its fellow of the opposite side. The tongue, the sub-lingual glands, and their vessels lie above this diaphragm, the sub-maxillary and some of the lymphatic glands and their vessels below.

From the sides and front of the tongue, its mucous membrane passes over the floor of the mouth and the sub-lingual

glands to the jaw: posteriorly to the fauces, pharynx, and epiglottis. In the anterior faucial pillar is the palato-glossus muscle, which limits tongue extrusion more, perhaps, than does the frenum linguæ itself. The lingual artery, passing beneath the hyoglossus, runs forwards along the outer surface of the geniohyoglossus muscle to the under surface of the tongue tip. Beneath the hyoglossus muscle it gives a large branch (dorsalis linguæ) upwards to the tongue base; on emerging from beneath the muscle another large branch (sub-lingual) is given to the sub-lingual glands and mucous membrane of the mouth-floor; and beyond this the lingual artery is called ranine.

The facial artery in the second part of its course is imbedded in the sub-maxillary gland, from which it curves over the side of the mandible on to the face close to the anterior margin of the masseter muscle. As the vessel emerges from the gland, the large sub-mental branch is given off and passes forward beneath the jaw margin, external to the mylohyoid muscle to the front of the chin. This vessel supplies the sub-maxillary salivary and lymphatic glands, and the neighbouring muscles. The mylohyoid branch of the inferior dental artery is given off close to the inferior dental foramen, and passes forward along the inner surface of the jaw above the mylohyoid muscle to the back of the symphysis. It gives branches to the mylohyoid and anterior belly of the digastric muscles.

The lingual vein commences as the ranine immediately beneath the mucous membrane under the tongue tip, runs superficial to the hyoglossus muscle, and passes deeply inwards to enter the internal jugular or to join the facial.

The facial vein collects most of the blood from the structures within the sub-maxillary triangle by means of the sub-mental and sub-maxillary branches, and, after joining one of the divisions of the temporo-maxillary, opens into the internal jugular.

The lymphatic vessels of the tongue and floor of the mouth, as elsewhere, follow the direction of the larger arteries, and enter in their course groups of lymphatic glands

with whose exact anatomy the operating surgeon must be familiar. The two groups of lymphatic glands which chiefly concern us to-night are the sub-maxillary and the superior deep cervical.

The sub-maxillary lymphatic glands—ten to twelve in number—occupy the digastric triangle. One or two of the most anterior of them are called suprahyoid glands. The vessels which reach them come from the floor of the mouth, the anterior part of the tongue, the sub-maxillary and sub-lingual salivary glands, the anterior part of the face, and the more anterior parts of the parotid glands. Their different ducts pass partly to the superficial cervical glands, but chiefly into the deep cervical group.

The superior deep cervical glands form a chain which lies by the side of the internal jugular vein, in the region between the base of the skull and the thyroid cartilage. They receive the lymphatics from the sub-maxillary groups, from the posterior part of the tongue, and from other adjacent structures (pharynx, larynx, cranial cavity, etc.).

In connection with the lymphatics from the posterior part of the tongue, one or two small lingual glands are found on the outer surface of the hyoglossus muscle. The efferent ducts from the superior deep cervical glands are continued to the inferior deep cervical glands.

Partial removal of the tongue may be called for in early epithelioma, leucoplakia, fibroma, nevoid, papillomatous and other tumours; macroglossia, tuberculous and other ulcerations. The plan of removal may be by "wedge," "ellipse," or "lateral half," according to the physical nature of the lesion. All incisions from within the mouth are best made with scissors, and, as a rule, the long-handled, blunt-ended, straight-bladed pattern is the most convenient; it cuts to the end of its blades, and can be handled with more accuracy than either a curved or angular instrument. The mouth must be gagged widely open—as a rule, on the affected side—and one or more stout loops of silk ligature passed deeply through the tip of the tongue. The part to be

operated on must be pulled well outside the mouth if possible, the frenum being freely divided into the buccal floor and the anterior pillars of the fauces also if necessary. Should the lesion upon which you are operating be too far back in the tongue to be dragged outside, or should it be attached to the floor of the mouth, the cheek may be split from the labial angle backwards, and slightly downwards as far as the anterior border of the masseter muscle, the facial vessels and their branches being tied as they are divided. This incision gives easy access to the back of the tongue, and does not leave an unsightly scar if its inner and outer edges are accurately co-opted.

Before cutting into a tongue, always make up your mind definitely where you are going to cut and how much you are going to cut, and then cut expeditiously, not troubling much about ordinary bleeding until the removal is completed and the whole area of your wound lies open before you, and then do not hurry. Do not snap excitedly at bleeding areas with forceps or fingers, but proceed deliberately and quickly to pick up the busiest of the bleeding points, and tie them with fine sterilised silk. Sew the edges of the wound together with a full curved intestinal needle carrying reliable medium-sized, catgut suture, either continuously or in interruption. Before suturing intrabuccal wounds of all kinds, I often paint them freely over with a mixture of tincture of benzoin and powdered iodoform—as recommended by Whitehead—and have thought at times there was an advantage in doing so, but I have often left the raw surfaces quite untouched by medicinal applications of any kind without the least harm following.

When operating on the tongue through the mouth, I have for many years practised a method of keeping the organ extruded by means of knitting needles, which is of real value, and which, so far as I know, has not hitherto been described. The mouth being gagged open, and ligatures passed through the tongue tip in the usual manner, the organ is pulled out between the teeth as far as possible, the frenum and anterior faucial pillars being divided if necessary. A

stout knitting needle, with blunt and smoothly rounded ends, is entered close to the angle of the mouth; its point is dipped deeply downwards and backwards towards the root of the tongue, into which it is thrust midway between its upper and lower borders, and pushed transversely on through to the other side, where the emerging needle lies deeply in the mouth, and must be brought forward to engage on the opposite labial angle by lifting its point forwards and drawing the angle of the mouth backwards. The needle is then pushed on until the tongue occupies its central part. By this arrangement the tongue is kept fully extruded and exposed from tip to base: the angles of the mouth being forcibly retracted at the same time. Part or the whole of the extruded organ in front of the needle may be cut away or dealt with in any other manner; bleeding vessels may be easily caught and tied; the wound surfaces may be everywhere examined, and applications applied to them if required; cut edges may be sutured together; and when the operation is satisfactorily completed, the transfixing needle is withdrawn, and the stump then falls back into position in the floor of the mouth. I have never seen the slightest after-trouble from the stab through the tongue substance, and, if the needle-end be smoothly rounded, the lingual artery or vein cannot be punctured.

When a lateral half of the organ is to be removed, the steps of the operation are somewhat different. A ligature should be passed vertically through each side of the tongue-tip, the frenum freely divided, and an incision carried through the mucous membrane of the floor of the mouth on the side to be removed, outwards to the jaw, and backwards between the jaw and the side of the tongue to the anterior pillar of the fauces, which must be freely severed. The dorsum of the tongue must be deeply cut downwards, in the middle line from base to tip with a straight probe-ended bistoury, and the median division completed by tearing the geniohyoglossi muscles apart from each other through their whole length. The attachment of this muscle to the genial tubercle on the side to be removed may now be cut through

close to the jaw by pulling the loose half of the tongue upwards and outwards, and dipping the point of the scissors directly downwards behind the incisor teeth, taking care that the opposite muscle is not injured at the same time. If this muscle is properly divided the half of the tongue can be pulled upwards over the upper teeth with great freedom, and the hyoglossus muscle readily recognised, with the lingual artery lying at its inner side between it and the outer surface of the divided geniohyoglossus. The vessel must be found by the help of the blunt ends of the scissors, traced as far back as possible, and caught with an artery forceps before being cut through. The hyoglossus muscle may now be snipped through, and the hypoglossal nerve and lingual vein on its outer side divided. The vein, as a rule, does not require a ligature. The base of the tongue is now cut horizontally through behind the circumvallate papillæ, and as near to the hyoid bone as may be thought necessary. Two or three small branches of the dorsalis linguæ or tonsillar and ascending palatine branches of the facial artery have to be caught and tied. The half-tongue may be doubled inwards on itself, and its tip fixed with catgut sutures to the edge of its base as far back as conveniently possible. This doubling of half a tongue upon itself materially diminishes the area of the wound, lessens the chance of reactionary and secondary hæmorrhage, shortens the healing process, and leaves a stump by the help of which patients speak, eat, and swallow better than when the ordinary course is followed. When removing a lateral half of the tongue it is quite easy to take away at the same time the corresponding sublingual gland, and if the operation is being done for carcinoma, and the mucous membrane at the side of the organ is much affected, I think it should always be done. It is but little use searching for lymphatic glands from within the cavity of the mouth. The operation just described, therefore, is applicable to those early cases of carcinoma—wrongly spoken of, I think, as "pre-cancerous"—where careful examination fails even to detect a suspicion of enlargement of the lymphatic glands. Whenever lymphatic infection is present, even although the

primary growth be small and readily accessible through the mouth, I think one of the extra-buccal operations should be straightway performed. In such cases it is sometimes advised to remove the lateral half of the tongue first, and a few weeks later, when the mouth wound is healed, to excise the glands from beneath the jaw; and, although I have adopted this method on several occasions, and with the happiest results, I do not think it is surgically sound. Removal of a lateral half of the tongue for cancer is a good operation in suitable cases, and should always be considered. Its mortality is low; its results, both immediate and remote, are excellent; after recovery, the voice is plainer and the feeding is easier; patients will more readily submit to it than they will to the loss of the whole organ.

Complete removal of the tongue has been carried out by numberless operative methods, most of which, fortunately for suffering humanity, are obsolete and almost forgotten. The earliest successful operation of which we have record was performed by Pimpernelli in 1658. In 1833 preliminary ligature of the lingual artery was first performed by Mirault; three years after which, division of the lower jaw was practised by Roux, to be followed two years later by the first infra-maxillary operation of Regnoli. Czerny and Billroth modified this procedure some years later, but it was not until 1880 that Kocher introduced his now well-known, but often badly-performed, operation. Out of the multitude of complete excisions, I shall refer only to three, because I consider them all-sufficient for the purposes for which they have been devised, and because I have proved their worth in my own practice. They are Whitehead's, Syme's, and Kocher's operations.

Whitehead's operation consists in the removal of the whole tongue through the mouth entirely with scissors. The steps of the operation up to the final section through the tongue-base are precisely those which had been taken by surgeons before Whitehead's time, but it was left for him to do the whole thing with scissors, and in this alone lies the originality of Whitehead's procedure. The description I

have already given of removal of a lateral half details the first steps of the operation, and need not, therefore, be repeated. After the tongue has been freed from its lateral attachments in the middle line, each half is removed separately, whilst others remove the tongue *en masse*, taking care in the latter case to cut through the base one half at a time, so as to secure the lingual of one side before attacking the other. All intra-buccal operations leave the lymphatic areas of the tongue untouched, and are suitable therefore only for simple or early cancerous cases. When cancerous disease is so extensive that the whole organ calls for removal, we ought to assume the existence of lymphatic gland infection—whether it is obvious or not—and one of the extra-buccal operations should be performed, and of these I think Kocher and Syme are the best.

Kocher's operation consists in removal of the tongue, the lymphatic glands, and all the tissues which intervene between them and the primary seat of disease through an infra-maxillary incision made behind and below the angle of the jaw. It gives good access to the parts, admits of preliminary ligature of the lingual artery on the affected side, and allows of antiseptic treatment of the wound. In principle, it resembles in many ways the modern operation for removal of the cancerous breast, with its underlying pectoral muscle and the contents of the axilla, and must be carried out with the same thoroughness and care. I shall describe the operation as it seems to me most conveniently performed, modifying details only of the original procedure. Kocher always does a preliminary tracheotomy or laryngotomy. In this matter I do not follow him. I can get through the operation quite well without it, and am satisfied that afterwards a patient does better without an opening in his air tube than with one. Inasmuch as the greater part of the operation may be done before the cavity of the mouth is cut into, the danger of blood getting into the air passages in serious quantity is not very great. The head of the patient should be fixed firmly on a sand pillow with the face turned towards the opposite side, and an incision made from

a point just behind the symphysis of the jaw and directly downwards in the middle line to the hyoid bone, along the upper border of that bone outwards to the sterno-mastoid muscle, and lastly upwards, along the anterior edge of this muscle to just above the level of the angle of the jaw. Reflect upwards as far as the outer surface of the body of the jaw, the flap of skin and platysma muscle, and fix it to the cheek with a suture; cut through subcutaneous fatty tissues down to the deep fascia, ligaturing anterior and external jugular veins, if necessary. The deep fascia is now freely divided along the whole length of the wound, and the lower edge of the submaxillary gland found, and turned upwards as high as possible until the whole gland is drawn over the body of the jaw; the tendon of the digastric muscle is seen and drawn downwards, its anterior belly being followed up to its attachment to the jaw, and its posterior backwards nearly to the mastoid. Deeper than the digastric will be recognised in front the mylohyoid muscle, with its free posterior edge; and behind, and at a deeper level, the hyoglossus muscle, whose fibres run vertically downwards, and upon which lies the hypoglossal nerve and the lingual vein. The mylohyoid muscle must be divided close to the middle line, from its posterior border forwards to the symphysis, and again close to its attachment to the inner surface of the jaw in operations for cancer affecting the anterior parts of the tongue or floor of the mouth. The hypoglossal nerve and lingual vein are now divided, and the hyoglossus muscle snipped carefully through just above the level of the hyoid bone, the lingual artery beneath being found and caught with forceps before it is divided and tied. At this stage of the operation it is most convenient to complete the removal of the submaxillary gland and its duct, as well as infected lymphatic glands in its immediate neighbourhood. Through the anterior part of the wound the geniohyoglossus muscles of both sides must be divided immediately behind the genial tubercles. Up to this point all bleeding has been outside the mouth, and the work of the anæsthetist has not been embarrassed. The mouth is now gagged widely open;

the tongue transfixed at its tip with a stout ligature and drawn forwards, then with scissors cut through the frenum close to the floor of the mouth, and continue the incision backwards on either side through the mucous membrane close to the jaw as far as the faucial pillar, which is to be freely divided. The tongue is liberated to some extent after division of the frenum, but it is the palato-glossi muscles which chiefly check protrusion, and when they are divided the organ can be drawn much further out of the mouth. A finger may now be pushed through the floor of the mouth into the outer wound, and the separation of the soft parts from the jaw completed. The tongue is then pulled downwards through the open floor of the mouth, and cut through close to the hyoid bone by repeated snips of the scissor points, the near half being divided first, and the lingual artery on the far side seen and caught in forceps before division after the second geniohyoglossus muscle has been cut through. Several smaller bleeding vessels have to be taken up during the operation, coming from the submental branch of the facial and sublingual branch of the lingual in the anterior half of the wound, and from the mylohyoid branch of the inferior dental and tonsillar and ascending branches of the facial in the posterior and deeper half. The tongue being removed, attention must be directed to the deeper lymphatic infection which follows in the course of the lingual artery to the great vessels of the neck; and, as the first step in this investigation, I would advise you to make deliberately for the internal jugular vein, for when you have found and clearly defined this structure, it ought to be impossible for you to injure it. In all deep dissecting operations the way to avoid damage to a structure is to see it, and not to try to protect it by not seeing it at all. Having cleared away every trace of lymphatic infection, the anterior and posterior thirds of the wound edges only are brought together, the remaining third being left widely open so that the whole wound may be packed with iodoform gauze, which may be changed as frequently as is desirable.

Syme's operation is, theoretically at least, an ideal operation for complete removal of the cancerous tongue. It is a severe procedure doubtless, but it gives the surgeon readier access to the tongue and the other soft tissues lying within the concavity of the mandible than does any other method. The patient may lie flat on the back with the head turned well on its side towards the operator, and slightly raised on a sand pillow. I have sometimes operated with the head hanging downwards over the end of the table, and sometimes with the patient sitting nearly upright for the purpose of keeping blood and mucus out of the air passages, but do not think there is much practical gain in either of these latter positions. A deep incision is carried exactly in the middle line from the edge of the lower lip downwards over the point of the chin, and on as far as the hyoid bone. Let this incision be deep enough, dividing the lip and chin through to the bone, and the parts behind the chin through the mylohyoid muscle into the substance of the tongue. The parts must now be reflected from either side of the front of the jaw for about half an inch, and two holes drilled through its body on either side just below the tooth sockets. A little point on the exact direction of these drill holes is useful: instead of entering the drill at points on each side about half an inch from the midline, keep the points closer together, say, with not more than one-eighth of an inch between them, but slanting the drill in such manner that the points of emergence at the back of the bone shall be from three-quarters to an inch apart; fixing on this principle prevents much of the slipping of fragments on each other, which is the great bar to rapid recovery in Syme's operation. The jaw is now sawn three-quarters through with a metacarpal or Hey's saw, and its division completed with a cutting pliers. There is no need to draw an incisor tooth, as is sometimes advised. The halves of the divided jaw are forcibly pulled apart, the tongue having been transfixed with a ligature through its tip in the ordinary way. The soft parts are cut away with scissors from each side of the jaw, commencing in front with the geniohyoglossus muscle, avoiding the geniohyoid, but

removing the mylohyoid, and passing backwards through the stylo-glossus muscle, the anterior faucial pillars to the glosso-epiglottidean pouch. When the lateral attachments have been freed, the tongue is finally cut through its base just above the hyoid bone, the lingual artery on one side being secured before the other is divided. Attention should then be directed to the areas of probable lymphatic infection, as already referred to in describing Kocher's operation; and when that part of the operation is completed, the jaw surfaces are fixed together with stout wire, the lip edges carefully apposed, and the rest of the wound closed with sutures, leaving a large drain through the floor of the mouth just in front of the hyoid bone.

The after-treatment of major tongue operations is of as much importance as the operation itself. The one threatening danger against which the patient may be safeguarded is septic broncho-pneumonia and its consequences. This form of pneumonia results from the entrance into the air passages of decomposing blood, inflammatory exudate, and foodstuffs; its extension from the bronchi to the lung parenchyma is favoured by pulmonary congestion. Prophylactic treatment, therefore, consists in keeping the wound as aseptic as possible by means of antiseptic applications. Of these, I think chlorine water, perchloride solutions, and iodoform crystals are the best. Liquid meals of fifteen to twenty ounces should be given through a tube passed into the stomach at three or four hour intervals; and, lastly, patients must be sat upright in bed as soon as they recover from the shock and the anæsthetic, and must be got regularly out of bed into an easy chair from the second or third day after operation.

"As to the propriety of operating at all for the removal of cancer of the tongue (wrote Barker nearly a quarter of a century ago), there can hardly be any doubt at the present day, although there is still a tendency in the minds of some surgeons to regard the operation with little favour. The question turns upon two points: First, is it possible to rid a patient permanently of his disease who once has cancer of the tongue? This question may be answered in the affirmative in a certain proportion of cases, for surely, if there is one

species of cancer more than another which remains for a time a purely local affection, it is epithelioma; and when it is in a position in which it can be isolated with ease, and in which it can be recognised at its earliest inception, it certainly ought to be curable by operation. "Why, then," it is urged, "does recurrence take place in the vast majority of tongue cancers operated on?" The answer is that hitherto either the public has not been aware of the great gravity of even the smallest trace of cancerous disease of the tongue, or the general diagnostic powers of our profession have not come up to the needs of the case in the early recognition of the disease, or the necessary knowledge that nothing but free and early removal of the part affected will secure a patient from recurrence is not as widely diffused as it ought to be; finally, there is a popular dread of removal of the tongue, based upon the belief that with the loss of part or the whole of the organ patients are bereft of the power of speech. When it is better known that this is an unfounded fear, and also the fact that when epithelioma is taken early, removal of half the tongue will suffice to secure against its return, we may hope for less hesitation in seeking early relief."

Twenty-five years' further surgical experience only confirms the professional opinions embodied in these sentences, but whether the public attitude has been in any way changed during the period is quite another matter. If it has—and I do not say that it has not—there is even still much room for "betterment" in the matter of early operations for cancer. Barker then goes on to say: "But there is another aspect of the question hardly less important than that of the complete extirpation of the cancerous disease, namely, that, even supposing in any given case we cannot hope to secure the patient from recurrence, the disease having gone too far, we may yet, by free excision of the organ, give very great relief for the rest of the sufferer's life, even if we should not prolong it. It is now a well-known experience that when recurrence after such operations does take place it is unusual for it to appear in any part of the stump of the tongue or mouth; the glands of the neck and the internal organs become the seat of the finally fatal recurrence."

I am not sure that in this matter Barker is altogether right—at least, such is not my experience. Recurrences after operations for cancer locally in the glands or in internal organs are always extremely disappointing to patients and their friends, and do more than anything else, in my opinion, to keep other sufferers from submitting themselves to early operation. They deter rather than encourage, and lead patients to avoid surgical interference until it becomes painfully obvious to themselves that all else has failed them. I am opposed to the performance of late operations solely on the ground that it gives an "only chance," for, although an occasional success may be won in an apparently hopeless case, I am quite sure that the present practice of operating as an "only chance" costs infinitely more lives in the long run than are saved by attempting the almost surgically impossible. If for a generation surgeons would decline to perform operations for approximately hopeless conditions—when due to patients' own delay or to a medical attendant's want of knowledge—the operative mortality of many otherwise fatal maladies would fall, and the eyes of the public would not remain blind to the priceless advantages of timely surgical treatment. The closest study of all morbid conditions of the tongue which appear to eventuate in epithelioma is called for, and all delay in dealing with the latter is fraught with danger, free removal being demanded as early as may be, in order to secure the possibility of non-recurrence, and also to render unnecessary those extensive operations which are dangerous in many ways. The hope of the future lies more in improved and more generally diffused powers of early diagnosis than in the further development of severe operations.

I have said nothing about those operations where parts of the lower jaw have to be removed at the same time as the tongue, and chiefly for the reason that my own experience of them does not prejudice me in their favour. Of course, they are possible enough in the hands of any experienced operator, but whether the ultimate benefit of the patient justifies the majority of them is quite another matter. In my hands it certainly has not.

ON THE EXAMINATION OF THE DISEASED RECTUM; WITH SPECIAL REFERENCE TO THE INSPECTION OF ITS UPPER PORTION BY THE SIGMOIDOSCOPE.*

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Examination of the anus and rectum is not a very pleasant process either for the surgeon to undertake or for the patient to submit to. Nevertheless, it is a highly important duty, by which alone treatment of disease affecting these parts can be satisfactorily conducted.

It is, perhaps, not superfluous to remark that an actual examination should be made in all cases of anal and rectal trouble.

If the symptoms can be entirely accounted for by the external appearances, inspection and palpation of these will alone suffice in the first place.

If, on the other hand, the surgeon does not feel satisfied, and considers that the portion beyond the sphincter is accountable for the symptoms, he should not hesitate to avail himself of such means as will enable him to ascertain the origin of the evil.

The investigation must be conducted with delicacy and circumspection, but at the same time, when made at all, it must be made thoroughly.

Before resorting to the internal examination, it is imperative to get rid of any fæcal matter that may be present, and which will entirely prevent the satisfactory determination of disease. If possible, then, the rectum should be previously washed out with a soapsuds enema about an hour before the appointed time.

* A Paper read before the Birmingham Branch of the British Medical Association.

If the large intestine is loaded, means must be taken to empty it a sufficient time before the examination to allow for the bowels to cease acting. I find in practice that it is usually sufficient to simply wash the rectum out, and that only in exceptional cases is an aperient necessary.

Finger.—The finger I prefer is the right forefinger. The nail should be carefully trimmed, and it may be anointed with some such stiff ointment as a modification of the ung. simplex made by reducing the amount of almond oil, *e.g.*, white wax 2oz., benz. lard 3oz., almond oil 1oz.

Position.—The best position for men to assume during digital examination is the genu pectoral, or rather, perhaps, the knee-elbow position, in which the patient kneels upon a couch, and supports the fore part of the trunk with the elbows, the thighs being flexed to rather more than a right angle.

When examining women digitally or instrumentally, and also during the examination of both women and men by the proctoscope or sigmoidoscope, I prefer Sim's position, the patient lying on the left side, the buttocks being supported by a pillow, and the thighs well drawn up. In this way patients are more at rest; any pain or sickly sensation produced by the instrumentation is more easily borne; and they are unable to retreat before the pressure caused by the introduction of the instrument.

In addition, since, when using a tubular instrument, it is thus passed in a downward direction, mucus, blood, or fæces cannot flow down it and obstruct the view, and the rectum is at the same time able to balloon.

Ballooning of the rectum, which is more or less essential in the examination by Kelly's instruments, is best obtained when the patient is in the dorsal position, the buttocks being very much raised and the thighs thoroughly flexed. In this way the upper part of the rectum is freed from the pressure of the abdominal contents, which move towards the diaphragm. Personally, I do not profess to have had much experience of this ballooning, since it is not required by the instrument that I advocate.

The patient being now in position, the introduction either of the finger or of a speculum is considerably facilitated if he is told to strain or bear down. By so doing the anus is protruded, the sphincter is relaxed as in normal defæcation, and the upper regions of the rectum are brought nearer to the exterior.

The bearing-down process is particularly important for the examination of internal piles, for if the margins of the anus be at the same time separated they may very often be made to prolapse. Fissures also are more thoroughly exposed in this way.

Some authors have recommended the forcible eversion of the anterior wall of the rectum by pressure in the vagina. It is a somewhat clumsy proceeding, and, in my opinion, both difficult and painful without an anæsthetic. It gives a very limited view of the rectal wall, and should only be attempted in parous women.

The extent of the rectum that can be examined digitally varies considerably with the length of the surgeon's finger and the patient's endurance. It is undoubtedly a fact that great pain is often caused by the force used during high examination of the rectum with the finger. It follows, therefore, that such examinations should be conducted very deliberately and as gently as possible.

Under the most favourable circumstances, it is seldom that more than four inches of the rectum can be reached by digital palpation.

In contrast to this, I believe that less pain is inflicted by a tubular speculum, while it is possible to examine the whole extent of the rectum by this means.

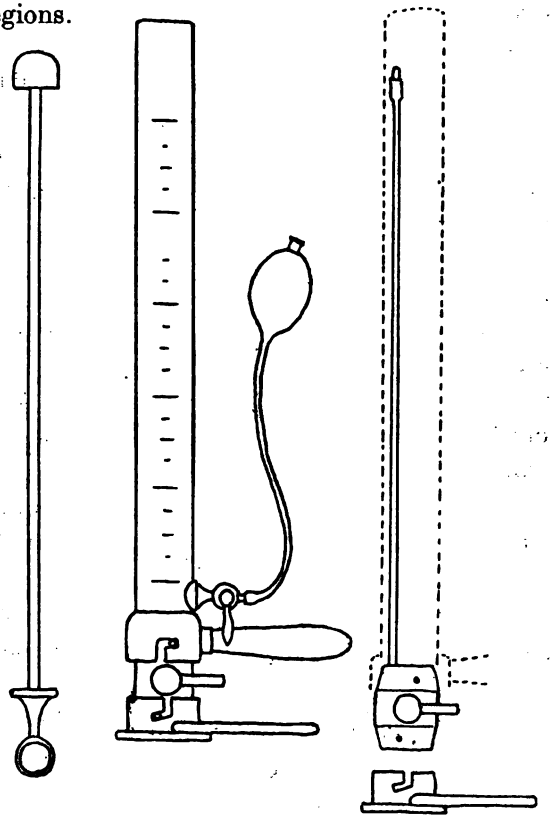
Where it is determined to undertake an instrumental investigation, the following agents and instruments should be requisitioned :—

A firm couch and arrangement of pillows to support the buttocks.
A good light and a mirror.
Various specula and anal dilators.
Probes and bougies.
Occasionally an anæsthetic and administrator.

And for the higher examinations, with the more complicated instruments, an able assistant.

There are a number of rectal specula on the market, all of more or less value. Matthieu's, Lane's, Hilton's, Bryant's, Allingham's, or Davy's—which I have here—are possessed of two, three, or four blades or rods, which are made to diverge by action at the handles. Such instruments necessitate the forcible dilatation of the rectum, and will in many cases require the use of an anæsthetic. They are chiefly intended for operations on the anus and lower rectum.

The tubular specula of Kelly, Laws, Pennington, and Strauss will be found more convenient for simple examination without an anæsthetic, and exploration of the higher rectal regions.



SIGMOIDOSCOPE (STRAUSS).

Strauss's sigmoidoscope is a tubular instrument 30cms. long, and has a calibre of 2cms. It is possessed at the back

of two removable metal collars. The hinder one is fitted with a glass window, through which inspection is made. To the one anterior to it is attached a wire fitted with a small electric lamp. When fixed in position, this lamp is within an inch of the further end of the tube, and therefore in close proximity to the exposed wall of the rectum. With a ten-volt pressure, the lamp gives an excellent illumination, which may be varied by use of the small resistance coil provided with the instrument. By means of an india-rubber bellows, air may be blown into the tube and thus into the rectum, for the purpose of distending and straightening its lumen, the window at the back preventing its escape at that end.

Both this and Kelly's instruments are provided with a conical obturator, by which entrance past the sphincter is first effected, and which is then withdrawn. The instrument is then gently passed backward towards the sacrum; then upwards in the median line for about four inches through the second part, and finally turned towards the left to gain the first part. Strauss's or Law's sigmoidoscope is the one I have used in this manner. With this instrument, when the small lamp in the end of the tube is illuminated, one can follow throughout the rectal lumen, and thus pass through it accurately and without pain, and I have not experienced any actual obstruction from the rectal valves.

During the deeper introduction of the instrument, it is advantageous, I find, to slightly inflate the rectum, and thus separate its walls, by compression of the india-rubber ball. When the sigmoid flexure is reached, the introduction of the instrument into this region is facilitated by further slight puffs of air, whereby the colonic wall is straightened and blown away from the advancing tube. Should no morbid appearances be discovered during introduction, the sigmoidoscope is slowly withdrawn, and the rectal walls closely watched as the open end of the instrument passes by and reveals them. It is important to remember that if the air with which the rectum has been inflated be allowed to escape suddenly, the rectal wall may be damaged by coming into sudden contact with the end of the instrument.

The following morbid signs and appearances may be denoted by the examination of the anus and its neighbourhood :—

External piles, either recent, organised, thrombosed, sentinel, or sloughing.
Prolapsed mucous membrane.
Anal fissures.
Inflammatory induration and swelling.
Ruptured or patulous sphincter.
The external orifices of fistulæ.
Eczema and excoriations.
Wounds.
Syphilitic lesions.
Malignant and tubercular ulcerations.
Protruding polypi, intussusception and foreign bodies, &c.

When examining the interior of the rectum, we may determine *by palpation* the presence of internal piles, internal fistulæ, simple malignant and granulomatous ulcerations and new growths, strictures, intussusceptions, foreign bodies, impacted fæces and scybala, inflammatory swellings in the ischio-rectal fossæ, ballooning of the rectum, and the presence of organs and tumours external to its walls. By inspection through an instrument, we can actually see all that can be felt in the rectal wall itself, and, in addition, the parts beyond the reach of the finger can be thoroughly explored. Further than this, inspection will enable us to more accurately determine the presence of internal piles, congestive and ulcerative conditions of the mucous membrane, ruptured venous orifices, ecchymoses, shallow ulcers, and wounds. To complete such an examination, the surgeon will do well to be provided with mops on handles to remove blood, mucus, and fæces, probes to pass into fistulous orifices, and bougies to explore the calibre of strictures.

Having now conducted the local examination, it will be found in many cases highly important to turn one's attention to the constitutional condition of the patient, and to ascertain in particular, by investigation of the abdominal wall, if any lesions of the sigmoid, colon, or liver exist. It will be

well also to determine the appearance and constituents of the fæces and urine, as well as to ascertain the condition of the heart, lungs, and nervous system. In this way we shall gain the broadest and most unprejudiced knowledge of our patients' illness.

I have brought this subject forward to-day for the following reason. I believe it has been too generally considered that the upper part of the rectum is inaccessible to exploration without the performance of a severe operation. The short acquaintance that I have had with this particular form of speculum (Strauss's) has, however, convinced me that the interior of the whole rectum and termination of the sigmoid may be viewed with the greatest precision, and with very little discomfort to the patient.

The *first case* on which I used the instrument was a man aged forty-seven years, who was subject to periodical profuse rectal hæmorrhage, anæmia, apparent emaciation, and constant pain in the back. He was the subject of slight internal hæmorrhoids without prolapse. Under these conditions, I thought it right to eliminate the possibility of higher mischief, and I was able to pass the sigmoidoscope for 25cm. (ten inches) without encountering any difficulties. Very little pain was felt, but there was a slight sensation of faintness, which soon passed off, and he was able to depart home ten minutes afterwards. In this case, therefore, I was subsequently able to treat his hæmorrhoids successfully without the fear that a high cancer was at the bottom of his troubles.

A *second case* was a middle-aged man who had been passing mucus in his stools for some months, with a sense of fulness and weight in the rectum. The sigmoidoscope was passed with more difficulty on this occasion, and I desisted on reaching 15cms., on account of the pain inflicted and because the view obtained, which was excellent, coincided with my previous opinion, that it was merely a case of chronic proctitis. The pain felt in this instance was undoubtedly due to the presence of proctitis.

A *third case*, and the last that I shall here refer to, I was enabled to examine by the courtesy of Mr. Barling. I

regret that I have only been able to obtain a very imperfect history of his trouble. The patient, a middle-aged man, has suffered for some months past from recurring attacks of constipation and pain, with the passage of blood and mucus. These have passed off in a few days, leaving him comparatively well. Digital examination revealed nothing. I passed the sigmoidoscope 13½cms., where it came to a dead stop, and on inspecting the interior of the bowel I could clearly see a tight stricture, surrounded by comparatively healthy mucous membrane. By manipulating the instrument, it was easy to ascertain that the stricture was decidedly fixed, and that the submucous tissues communicated a sensation as of sclerosis. There was no sign of ulceration or malignant disease, and the surface of the mucous membrane could be inspected most minutely. I take it that this was a case of post-ulcerative contraction, and curable by dilatation. Unfortunately, the patient elected to leave the hospital on the following day, but I trust will return for further treatment.*

In conclusion, I would point out how great an advance has been made in the art of surgical diagnosis by an instrument which enables us to gain a clear view of the whole of the rectal mucosa, even to the sigmoid, without the necessity for an anæsthetic and without the slightest danger. By its means we are enabled to dispense entirely with the older expedients, such as the introduction of the hand, the blind passage of bougies, the injection of fluids, or the operation of laparotomy, all of which have their dangers and are sometimes inefficacious. Yet these have been advocated until quite recently as the only methods of diagnosis for rectal strictures, etc., which are beyond the reach of the finger.

* Since reading this paper, the writer has been enabled, by the sigmoidoscope, to examine the lower bowel for a distance of 30 cms. (11½ inches). An anæsthetic was given.

PRACTICAL THERAPEUTICS.

TREATMENT OF PUERPERAL INFECTION.

RUDOLPH HOLMES.

A.—PUERPERAL infection is a generic term for a number Practical Therapeutics.
of acute infectious diseases of the lying-in period.

B.—We find various germs—streptococci, staphylococci, colon bacilli and various saphrophytic bacteria; less frequently pneumococci, typhoid, diphtheria, and gonorrhœa.

C.—The pathologic changes may be limited to circumscribed areas as a perineal ulcer, or more diffused so as to involve one of the several anatomic parts of the parturient canal or the entire genital canal, or extend beyond into adjacent structures.

D.—There cannot be a specific remedy for puerperal infection, as the primal direct factors are so devious.

PROPHYLAXIS.

"An ounce of prevention is worth a pound of cure."

Firstly, the obstetrician.—He must have "the antiseptic conscience." He must recognise that obstetrics is a branch of surgery, and that in the carrying out of the details of a simple forceps operation alone, assistance is as essential as in major surgery. The hands must be sufficiently scrubbed, more reliance being put upon mechanical rubbing than upon the uncertainty of chemical solutions. Rubber gloves are especially appropriate; the advantage of "boiled hands" is paramount. The gloves must be pulled on, and not milked on—a common method of soiling them by the unclean skin.

Secondly, the patient.—After giving an enema, the pubic hair must be clipped or shaved. The vulva is then thoroughly cleansed. The labia majora then being held apart, the fingers of the other hand are introduced into the introitus vaginæ. The examination under the sheet whereby the examining fingers first strike the anus and collect some

myriads of colon bacilli upon the finger tips, then sliding over the perineum into the vagina, can only be a source of contamination and infection. Remember that the healthy vagina of the pregnant woman is sterile within the hymenal orifice.

Thirdly.—All instruments and dressings must be sterile. The habit of putting forceps into a pitcher of boiling water is obsolete; a metal steriliser is the only means of safety.

Curative Measures.

The following assertions may be presented :—

A.—Puerperal infections have diverse anatomic sites. It would be folly and a danger to institute intra-uterine therapeutic measures in a vulvar or vaginal infection. We must be sure of our ground before we attempt any procedure.

B.—Even if a puerperal endometritis is granted, we have no method at our command to reach the offending germs, as they are deeply embedded in the hypertrophied endometrium, and even in the muscularis itself. The reactionary zone—the reaction zone of Bumm—consisting of a demarcation layer of small round cells, is best marked in infections by saptophytes, colon bacilli, and cocci of low virulence. Whilst the endometrium between the "zone of Bumm" and the uterine cavity is necrotic and laden with germs, the muscular tissue outside the reaction zone is germ-free. In virulent coccic conditions the extension is so rapid that the reaction zone has no time to form, and the cocci rapidly spread to the lymphatics and veins.

C.—The saprophytic infections are of low virulence, and, unless mixed, the patient usually recovers; per contra the coccic infections have a higher mortality.

D.—In saprophytic infections there is much debris in the uterine cavity, which, if removed by a curette, rapidly reforms.

E.—In coccic infections there is little or no material capable of removal, the endometrium being smooth.

F.—The presence or absence of odour is of no value in determining if infection has taken place; the ranker the odour, the more favourable the prognosis.

G.—The precursor of intelligent treatment must be bacteriological examination. Until a specific therapeutic measure is discovered for each of the numerous pathogenic germs which produce the symptom complex of puerperal infection, we should definitely consider that the course of the diseases is a self-limited one, the most essential factor being the "vis medicatrix natura." Puerperal fever is a self-limiting one, just as typhoid is.

I. *The Douche.*—It can only wash away purulent lochia from the uterine cavity. No antiseptic can, in the few moments of an intra-uterine douche, penetrate the endometrium and destroy the organisms deep within the tissues. Mercurial salts are dangerous in obstetric practice, in virtue of the absorption of the albumen-mercuric chloride. Its bactericidal properties of mercuric chloride, as Harrington has shown, are low. The intra-uterine douche as at present employed is directly dangerous, especially during the first week of the puerperium. It should never be entrusted to a nurse. The giving of an intro-uterine douche is really a major operation. First, the external parts must be sterilised; secondly, the vagina thoroughly cleansed; thirdly, a speculum introduced; fourthly, the cervix drawn down with a volcellum, and the douche point introduced into the cervical canal under the guidance of the eye. To guide the nozzle up the uncleansed vagina into the uterus may produce a mixed infection worse than the disease.

II. *The Curette.*—The curette has no place at any period of pregnancy in the face of an infection. The objections to the use of the curette are:—

(1) That it may remove the reaction zone of Bumm, nature's limiting investment, and may produce a fresh absorptive surface.

(2) That in coccic infections there is little to remove.

(3) That the offending organisms are too deep in the tissues for the curette to touch. It is physically impossible to remove all the endometrium, even in the non-parous uterus, by means of the curette; how much more impossible, then, is it to denude the endometrium of the parous uterus,

and especially of the puerperal one. The use of the finger, aided at times by a placental forceps, is more certain, more rational, and far less injurious than curettage. In simple uncomplicated endometritis, nature provides of itself an efficient safeguard which offers sufficient protection, but, as is frequently the case, the inflammatory process spreads deeply into the uterine wall, and occasionally to the peritoneum; but local measures are of small avail.

III. *Sera.*—Theoretically, sera are the only curative measures for puerperal infections; practically, they are of little use. The anti-streptococcic serum must be prepared from the same streptococcus which produces the disease to be of real service. As infections are prone to be of a composite form, a composite serum must be given, which would be a return to the old "shot-gun mixture." By careful bacteriological findings of the lochia, a reliable preparation of serum will in the future no doubt be produced.

IV. *Operative Measures.*—Of course, the same necessity exists for the evacuation of abscesses as in other surgical maladies. Hysterectomy is essentially an unjustifiable operation for puerperal infections. The sphere, of course, is limited to those grave infections still confined to the uterus. The exact depth of infection and the exact time to operate are beyond the ken of any man. The mortality of hysterectomy in such conditions is 50 per cent. There is little utility in removing the uterus, with an extension of the infection beyond its borders, and perhaps an actual septicæmia or pyæmia present. Having thrown down many false gods, what is left for the physician to do? As puerperal infections are self-limiting diseases, our measures should be directed towards supporting the constitutional strength, and generally allaying the septic process. Grant that the secundines have all come away, that the patient at the end of twenty-four to seventy-two hours has a sharp rise of temperature, acceleration of pulse, and possibly a chill :—

(1) Give the woman a full dose of some saline purge. Give a full dose of ergot. Repeat the ergot, combined with hydrastis, in medium-sized doses, in order to keep the uterus contracted. Watch the woman for further developments.

(2) In the course of twenty-four or forty-eight hours, if the woman is not better, then, possibly, an examination is indicated, which should include, as a preliminary procedure, a bacteriologic examination of the lochia taken *from the uterus*. At this examination, if a strong, putrid odour is present, we may suspect a saprophytic infection, and the possibility of retained secundines, or even a retained putrefying blood-clot. The finger, in passing over the uterine wall, will discover these if present, and should gently remove them.

Finally, a douche may be given to wash away the debris and such bacteria as may have been introduced by the examining fingers. In making this examination, I would strongly demand these conditions :—

(1) The vulva must be thoroughly cleansed, which should also comprise, at least, a close clipping of the vulvar hairs.

(2) The vagina must be thoroughly scrubbed with soap, lysol solution, etc., so we will not carry the vaginal lochia into the uterus ; we must always remember that by the second —or anyway, the third—day the lochia is essentially pus, its bacterial flora being normally of low virulency. In infections, this lochia is specially infective.

(3) After the examination it often is useful to place a small intra-uterine pack of plain sterile gauze, wrung out in a solution of formalin twenty to forty (20-40) drops to a pint, with perhaps its renewal next day. The formaldehyde is slowly liberated, has a great penetrating power, and continuously acts as an exceedingly powerful germicide.

(4) Continue the ergot and hydrastis ; exhibit such drugs which have a known power of increasing leucocytosis, as nuclein, nucleinic acid, and salt solution, hypodermically or per rectum, especially if the emunctories are sluggish. The ice-bag or hot applications to the abdomen deserve consideration. Unguentum crede, or collargolum, may be considered.

JOHN T. HEWETSON.

REVIEWS.

Text-book of Obstetrics. By CLARENCE WEBSTER, M.D. London: W. B. Saunders and Co.

THIS is undoubtedly one of the greatest expositions of this important branch of Medicine. Written by a comparatively young obstetrician, trained in the greatest British school of midwifery, who is a scientist to his finger tips, and whose experience in the practice of the subject is very considerable, this book quite comes up to one's expectations. The language of the work is dogmatic, clear, and in all respects characteristic of the author. His own scientific investigations are extensive and upon many subjects occupy considerable prominence. Particular attention is directed to the anatomical changes in pregnancy, labour and the puerperium, the description being largely based upon studies of frozen sections published by the author and other workers. Very accurate descriptions of embryological, physiological, and pathological data as applied to obstetrics have been made. One feels in reading through the pages that the scientific aspect of midwifery has been written by a master hand. The text-book, however, is not only eminently fitted to satisfy the yearnings of the scientific student, but is also valuable to the active practitioner. The practical side of the subject is dealt with in accuracy of detail, a fund of originality, and a wealth of common-sense which is very precious to the mind of a clinical worker. The best one can say of it is that it forms an exposition of obstetrics which is as highly scientific as it is practical. The volume contains 746 pages of letterpress, in clear type, on good smooth paper. The illustrations are well reproduced, comprising in all 383, twenty-three of which are in colours. The illustrations form a great feature of the work, are very distinct, and consist of drawings, photographs, and photo-micrographs descriptive of the

text. Dr. Webster is to be heartily congratulated upon his work, which has every promise of becoming a classic on the ancient art.

The Surgical Treatment of Bright's Disease. By GEORGE M. EDEBOHLS, M.D. New York: Frank F. Lisierki. 1904.

THE cure of Bright's disease by decapsulation of the kidneys is a subject which has been brought prominently forwards lately. Dr. Edebohls first thought of this mode of treatment, when he found that in eighteen cases, in which he had sutured the kidney for the cure of movable kidney, and in which, previous to operation, there had been albuminuria, the albumen disappeared from the urine after the kidney was fixed. That this does happen there can be no doubt, for any surgeon who has many times performed the operation of nephropexy will have observed both the association of albuminuria with mobility of the kidney, and also its disappearance after fixation of the kidney. As to this point, there can, we are sure, be no difference of opinion; but we differ most strongly from Dr. Edebohls when he holds that the presence of albumen in the urine of a patient suffering from movable kidney signifies the existence of Bright's disease. If it be held—and we think it is widely held—that the presence of albuminuria in these cases is symptomatic only, and does not indicate the presence of nephritis, then the list of seventy-two cases in which Dr. Edebohls performed the operation of decapsulation for the cure of nephritis must be considerable curtailed, and in this curtailment the records of many of the cases, in which the results were apparently most favourable, will disappear from the list. For the author to prove the efficacy of his treatment, he must first of all prove that the patients upon whom he operated suffered from Bright's disease. Dr. Edebohls' theory is that decapsulation of the kidneys is followed by the formation of adhesions between the kidneys and the surrounding structures, and that in these adhesions new arteries are formed, an additional blood supply to the kidneys being

thus constituted. Yet we notice that on page 132 the author, describing a second renal decapsulation on the same patient, does not mention that he saw these vessels, and, in fact, says "the entire operation, including the separation of the capsule from the kidney, was practically bloodless, owing possibly to the liberal venesection of the previous day." Does Dr. Edebohls really wish us to believe that newly-formed arteries, large enough to form an important new blood supply to the kidneys, were rendered undetectable simply because the patient had undergone venesection the day before?

The author says: "I am fully convinced that my contention, that renal decapsulation, because it will give us equally good results, is to be preferred to nephrotomy, resection of the kidneys, and nephrectomy, will be disputed by but few practical surgeons." If language means anything, then this sentence means that there is some condition for which renal decapsulation and nephrectomy are alternative forms of treatment. We shall be glad if Dr. Edebohls will, at some future time, explain to us what condition he refers to. Renal decapsulation may or may not come to be considered a good form of treatment for Bright's disease, but we cannot say that the careful reading of Dr. Edebohls' book has influenced one way or the other. Dr. Edebohls deals with the question in the spirit of the partisan, not in that of the unprejudiced observer. We do not say that his assertions are incorrect, but we do say that the correctness of them still awaits scientific proof.

Serums, Vaccines, and Toxines in Treatment and Diagnosis. By W. C. BOSANQUET, M.A., M.D., F.R.C.P. Cassell and Co., Ltd., London. 1904.

THIS is a book which supplies a distinct want. Germany has several such books, chief among which is Marx's most excellent little treatise, "Die experimentelle Diagnostik, Serumtherapia und Prophylaxe der Infectionskrankhasten," and one was rather inclined to regret that no English translation of it exists. However, the need for such a translation has disappeared with the appearance of the volume under consideration. It is intended to give to the medical practitioner and

the student of medicine a short account of the present position of knowledge with regard to the nature, immunity, and the methods adopted in the scientific treatment of disease by means of serums and vaccines. The author has performed his task in a most praiseworthy manner, considering the difficulties in the way. The subject is such a vast one, its growth is so rapid, and the complications which have arisen from the multiplication of terms and the elaboration of theories are so great, that the task of simplifying and reducing to the level of comprehension of the ordinary individual is no light one.

The figures illustrating Ehrlich's theory of immunity are distinctly useful in enabling one to grasp that author's conceptions of what occurs within the body during the reaction to a poison or foreign cell. One misses, however, what is now being recognised as the most important of recent advances in serum therapeutics, namely, the investigations of Wright on the importance of studying the physiology of immunity, on the existence of negative and positive phases in connection with the process, and on the presence of bodies in the serum without which phagocytosis does not take place. Certainly the multiplication of terms is to be deprecated in a subject where already there is too much confusion and ambiguity, but the evidence in favour of the existence of opsonines is now overwhelming. Further, we fail to see the necessity of two names for the thermolabile body in the immune serum; surely the word complement is more generally used and understood than the term alexine.

Clinical Diagnostic Bacteriology, including Serum Diagnosis and Cyto-diagnosis. By ALFRED C. COLES, M.D., D.Sc., F.R.S. Ed. London: J. and A. Churchill. 1904.

THIS work is intended as a handbook for the practitioner who has not the resources of a laboratory at his disposal, but who wishes to avail himself of the aids to diagnosis furnished by a bacteriological examination of morbid fluids, etc. To this end, all mention of the appearances of organisms in cultures and their behaviour on inoculation into animals is

omitted, attention being focussed upon the more practical points of differential diagnosis between allied forms of bacteria and of the inferences to be drawn from such examinations as regards clinical procedure. As such, the work is, on the whole, admirably executed. The inclusion, however, of the author's research work on the "Acid-fast Bacteria" seems, in view of the aim of the book, a little out of place. The author's conclusions under this head are most interesting and valuable—these alone would surely have sufficed for the use of the practitioner; details of experiments on the action of different acids as decolouring agents appear somewhat superfluous. It might be pointed out that the essential difference in Weigert's modification of Gram's method is that the iodine solution used is three times the strength of that used in Gram's original method; not as is here stated—washing in xylol. In the case of sections, anilin-xylol is used as the differentiating medium.

A Short Treatise on Anti-Typhoid Inoculation. By A. E. WRIGHT, M.D. Westminster: Archibald Constable and Co., Ltd. 1904.

THIS little book, which is an amplification of a series of papers published in the *Practitioner*, is an able defence of the author's method of anti-typhoid vaccination. It is, however, much more than this. It contains in a concise form many of the author's more recent contributions to the subject of immunity. One of the most important of these is the bringing forward of the fact that the law of the negative and positive phase governs the production of bacteriotropic substances in the same way as it governs the production of anti-toxins. This latter point—the existence of a negative and a positive phase in connection with the production of anti-toxins—had previously been demonstrated by Ehrlich, Salmnsen, and Madsen. By means of his measurements of the bactericidal power of the blood after typhoid inoculations, and of the phagocytic power of the blood after staphylococcus inoculations, the author was able to show that the law applied to the development of anti-bacterial substances.

Immunisation against a particular toxin or bacterium must be carried out strictly in view of these facts. The practical points which emerge from a study of them are that, in inducing immunity towards a particular organism, the dose of the vaccine should not be too large, and a sufficient time must be allowed to elapse for the disappearance of the negative phase before the second dose is given; or, in other words, in administering the second dose, our endeavour must be to catch the wave of immunity on the rise if we are to attain the most advantageous results. To state the case more generally, in all these processes we must pay attention to the physiology of immunisation.

This physiological method of immunisation the author has carried out in his anti-typhoid inoculation. By this means he has found it better to give two small inoculations rather than a single large one. As regards dose, he has found that in the case of the first inoculation a quantity of vaccine representing 750 to 1,000 millions of dead typhoid bacilli gives the best results; in the case of the second inoculation, 1,500 to 2,000 millions of the same bacilli. The author finds that the inoculation of such quantities induces an ample elaboration of anti-tropic substances, without producing any severe constitutional reaction.

With regard to the statistical evidence brought forward in support of the method, we find that this is obtained chiefly from the returns from various sources during the South African War and also from India. The author gives due prominence to the difficulties in the way of coming to a conclusion on such returns, and to the fallacies which unquestionably have crept in. Chief among these may be mentioned the improper use of the method and the untrustworthy nature of the statements of patients. In spite of these various difficulties and fallacies, one cannot but admit that the author has proved his case with regard to the efficacy of the method. Particularly is this so when one compares the South African results with such results as those of Richmond Asylum, which were obtained, not under the stress and difficulties of war, nor

under the adverse conditions associated with the transfer of troops. The conclusions come to by the author in the light of these, avowedly imperfect, statistics are, in his own words, as follows :—

1. The incidence of typhoid fever was diminished by at least one half in the inoculated.

2. In the aggregate the proportion of deaths to cases among the inoculated has been rather less than half that among the uninoculated.

3. The reduction of death-rate in case of the inoculated has often exceeded, and has seldom fallen below, a four-fold reduction.

4. The evidence, so far as it goes, points to the persistence of the protective effect during the second year after inoculation.

After reading the book, one can only wonder at the short-sighted policy of the War Office in suspending the use of the method, although probably only for a time.

New Methods of Treatment. By Dr. LAUMONIER. Translated and edited from the French by H. W. SYERS, M.A., M.D. London : Archibald Constable and Co.

THIS is a translation of Dr. Laumonier's work, which we reviewed in the original when it first appeared.

We may remind our readers that this is not a manual of therapeutics, but a treatise on some of the methods of treatment now coming into general vogue—methods which are not of the ordinary pharmacopœial type, as gland extracts, serotherapy, vaccinations, and the more complex derivations of arsenic, opium, and a number of others.

While admitted by all thoughtful practitioners that many of these drugs are still *sub judice*, it is obviously our duty to give them, and all similar substances, a fair trial, and to extend our knowledge of their use and indications. Dr. Laumonier's book is one which gives much information concerning these preparations, their physiological action and indications. We are therefore glad to see it appear in English, and we congratulate Dr. H. W. Syers on the excellence

of his translation. We can recommend the book to those therapeutists who wish to obtain information concerning a very important departure in methods of treatment.

Asthma in Relation to the Nose. By ALEXANDER FRANCIS, M.B. London: Adlard and Son, Bartholomew Close.

THIS book is intended as a contribution towards the investigation into the relation between asthma and the nasal passages. The writer is of the opinion that asthma is not due directly to any obstruction of the nasal passages, for the nose rarely supplies the exciting cause of the asthmatic spasm. He believes that hypertrophic rhinitis, vascular engorgement of the turbinate bodies, mucous polypi, and other obstructive nasal lesions, do occasionally occur in conjunction with asthma, but that the importance of the association has been greatly exaggerated. The writer quotes several cases to show that asthmatic symptoms are aggravated rather than improved by surgical interference with the nose. He suggests that the respiratory centre is the part which must be blamed for the spasm, that centre being in an "unstable condition." This unstable condition is not clearly defined. It is described as reflexly brought about by irritation of a sensory nerve or sense organ. We do not think that this is a strong argument against the importance of removing, when present, nasal polypi, or other local defects. Although we cannot follow the author in all his reasoning, we are glad to admit the force of much that he says, and to acknowledge that the book shows a considerable grasp of the subject.

Le Ventre. By Drs. M. BOURCART and F. CAUTRU. Part I. Le Rein. By M. BOURCART. Paris: F. Alcan.

THIS is the first part of a work that has for its object the treatment of abdominal disease by massage on a scientific basis. In their preface the authors announce their intention of treating more particularly displacements of the abdominal organs. They emphasise the fact that the text-books of

anatomy describe the positions and relations of viscera in a general way, but if we would apply massage in cases of displacement and other lesions, we require a more practical acquaintance with the anatomy of the abdomen, especially with reference to the surface relations of the viscera in all positions. They remark, further, that massage, if properly applied, gives tangible results in movable kidney, constipation, congestion, and other lesions of the abdominal viscera. The essential is that massage must be properly applied, and they strongly deprecate this method of treatment by persons with no general anatomical or medical training, whose ignorance, to quote their own words, is capable of producing unheard-of mischief—persons who would not be allowed to extract a tooth or open a simple superficial abscess. There is a further touch of irony in the remark that many a medical man, who would not dream of allowing a labourer to drive his horse or his motor-car, will hand over his wife to have her abdomen massaged by a person whose only claim to knowledge may be that she was a bath attendant or a ward maid. They are of opinion that a few minutes' massage by the properly-trained hand of an educated person has better effects than all the methods of pétrissage of the unqualified exponent.

Part I. contains a general description of the anatomy of the abdomen and the methods of examining the organs. On this we need not dwell, for it is sufficient to say that the anatomical and physical details are fully described, but without unnecessary details. The essence of the book is contained in the second part, which describes the anatomy and relations of the movable kidney. Particular attention is paid to methods of exploration, all illustrated by photographs and carefully-prepared diagrams, the former showing the exact method of palpating kidneys for accurately determining their situation. Concerning the causes of nephroptosis, the authors do not believe that traumatism—blows, sudden shock, or falls—do not play any important part in producing displacement of the kidney; nor do they believe that the corset is as much at fault as many suppose. As the

result of experiments, they are of opinion that the corset diminishes the mobility of the kidney, though it may not keep it in its place. Should the kidney be considerably collapsed, the effect of the corset is then to keep it in abnormal position. At the same time, they strongly deprecate the custom of putting the corset off and on in the erect position, which they say is productive of the worst possible results, should the kidney be in the least movable.

Into the details of methods of applied massage we need not enter, for to be of practical use they must be studied on the body with the aid of the book. In this manner we believe that the copious illustrations will prove of material assistance. There are some diseases of the kidneys—nephritis, congestion, and colic—in which it is maintained that massage is of practical value. It is suggested that the influence of massage on the circulation in the abdominal vessels may explain the good results of this method of treatment. There is much in the book that is likely to be helpful, whatever our opinions may be as to the unwisdom of deferring operative means.

In the second volume of "Le Ventre" there is promised a description of the digestive organs, to be followed by a treatise on massage of the stomach and intestines and liver. The third volume, which is to deal with massage of the abdomen in diseases of the circulatory organs, is to complete the work.

ABSTRACTS.

GASTRIC SYMPTOMS IN PULMONARY TUBERCULOSIS.

LESIONS of the stomach and gastric digestion in phthisis have repeatedly been investigated. Newer and more accurate methods, however, warrant the subject being re-opened, and Pasquier, who has revised the whole question (*Thèse de Paris*, 1903), draws the following conclusions from his observations. In the early stages of pulmonary tuberculosis there is gastric hypersthenia with hyperchlorhydria. At an early date gastric chemistry is variable, but when excavation is present there is chronic gastritis, with failure of the gastric functions; secretion is insufficient, and the result is hyposthenia, and possibly anachlorhydria. The therapeutic indications, according to Pasquier, are that in the early period, when gastric function is stimulated, drugs which increase the secretion should not be administered. In this category are arsenic, quinine, kola, coca creosote and its derivatives. On the other hand, this is the period when oily preparations, such as cod liver oil, are of most service. Quinine may be used as a restrainer of gastric secretion. In a later stage, drugs, which according to the writer were contra-indicated, are now of use in stimulating the enfeebled functions of the stomach. The question of superalimentation is of importance, as it is evident that the ingestion of large amounts of food is harmful in hypersthenic states of the stomach, as they would have the effect of stimulating the already superabundant gastric secretion. Further, in the earlier stages, nitrogenous diet is contra-indicated, and the principal ingredients should be vegetables, fat, sugar, and other carbohydrates. When the glandular activity begins to fail, the amount of food may be increased in order to stimulate it, and good results may be obtained by a more ample diet.

THE GENERAL EFFECTS OF ANTIDIPHTHERITIC SERUM.

Now that the use of anti-diphtheritic serum has become so general, it is important to recognise some of its effects unconnected with diphtheria. For this purpose, Coldefy gives the results of 400 cases in which serum was injected as a prophylactic measure, and in which there was no diphtheria at the time. In six of these cases there was pyrexia, which appeared and disappeared rapidly. In eight pyrexia lasted a short time. In a tubercular patient the fever lasted over several days, and was a troublesome feature in the case, so that the writer advises that anti-diphtheritic serum should not be injected in cases of tuberculosis unless absolutely called for. Apart from such cases, the temperature phenomena following injection are, therefore, unimportant. Eruptions are one of the commonest results. In a few cases an eruption appears immediately; in others at a later date; but all within a fortnight of the injection, must usually about the fourth or fifth day. It is exceptional for post-injection eruptions to appear after the fifteenth day. Eruptions sometimes disappear to return at the end of a few days. In several cases the patients happened to have pyrexia from some other cause. The injection of anti-diphtheritic serum did not interfere with the fall of the temperature in these cases.

Albuminuria has given rise to considerable discussion. In the writer's series of four hundred cases it was present fourteen times, slight in amount, and only lasted two or three days. It usually appeared during the first week. It is, therefore, of trivial occurrence. Should the patient, however, be suffering from nephritis (non-diphtheritic), it would seem better not to use serum as a prophylactic measure, reserving it for cases in which diphtheria is actually present. The quantity of urine is not affected to any appreciable extent. In four cases there seemed to be an increase in the amount.

Arthralgia occurs in 3 per cent. of cases, and lasts three or four days. It sets in suddenly, and reaches its maximum

the second day. No bad effects result. It consists in violent pain in one or more joints, the knee being most usually affected, but the elbow, shoulder, and tempero-maxillary articulations are also involved. The pain is not accompanied by either swelling or redness of the skin. It is usually limited to the joint, but may extend along the limb. In other cases myalgia is complained of. This is of even shorter duration than arthralgia. In cases both of arthralgia and myalgia there are usually some pyrexia, and possibly eruption. In some cases the pain is sufficiently severe to require the application of an anodyne. In several cases sore throat and glandular swelling appeared. They seemed to constitute one of the general phenomena resulting from the injection. The former bore no resemblance to diphtheria, and both symptoms lasted a very short time. Serum rarely gives rise to any disturbance of the alimentary system. The writer has, however, observed fœtid diarrhœa, and he quotes Moizard as having noted the same fact. In one case the diarrhœa was accompanied by vomiting. Vulvitis was present in three cases, but the author does not feel justified in recognising any connection between such cases and serum injection. It has been stated that syncope, cardiac arythmia, trismus, and convulsions may result from injection. There were no such phenomena in any of the writer's 400 cases. He therefore believes that when these have been noted in cases of diphtheria treated with serum they should be attributed to the former. It is stated that post-diphtheritic paralysis is met with more frequently since this method of treating diphtheria has come into vogue. The explanation is obvious. In former times a large number of children died; now that the greater number of those treated with serum are saved, they live to show diphtheritic paralysis, and serum treatment is the best for this condition. The writer has noticed that, while none of these effects is severe, they are most marked and last longest in patients of feeble constitution or suffering from some other disorder, and that even in such patients there is nothing to fear from the results of serum injection.

AN EARLY SIGN OF CANCER.

ATTENTION has lately been drawn to a possible relationship between cancer and certain cutaneous lesions, notably angiomata. Mignon has collected and systematised several observations in support of this hypothesis (*Thèse de Paris*, 1903). His conclusions are as follows. Three varieties of skin lesion, when occurring together, denote either the presence of or tendency to cancerous formation. One of these consists in cutaneous angiomata brilliant red, and about the size of a millet seed or a lentil, slightly raised, soft to the touch. Secondly, wart-like growths the size of a pea, soft to touch, and of a slightly deeper colour than the skin, rarely pigmented. These may occur in the face and trunk, but only exceptionally on the limbs. Thirdly, pigmented patches, pale yellow or *café au lait* colour, varying in size, but generally about one millimetre long and half that width. These are usually smooth to touch, but sometimes may be slightly scaly. They are usually found on the neck and trunk, rarely on the face or limbs, and so far have never been met with on the extremities. Occurring alone, these lesions have much less value as an indication of cancer, especially angiomata, which are not infrequently met with in elderly subjects. The author found that 46 per cent. of cancer cases showed all three elements, whereas in fifty non-cancerous persons they were met with in 5 to 6 per cent. It is difficult to say at what time these lesions are produced in cancerous patients, although it is probable that angiomata appear a long time before the onset of malignant disease. In certain cases, however, the writer was able to prove their appearance a short time before the onset of cancerous symptoms. It is difficult to explain the occurrence of such lesions. They might be regarded as evidence of degeneration of the tissues due to development of the malignant tumour. Be that as it may, there seems to be some relationship between the existence of these cutaneous manifestations, whether congenital or not, and the development of a cancer growth, or, at any rate, a cancerous predisposition.

SPECIFIC TREATMENT OF HYDROCEPHALUS.

CHAVIALLE draws some attention to some important points in the clinical history and treatment of hydrocephalus (*Thèse de Paris*, 1903). He shows the importance of recognising the syphilitic origin of some cases. This fact alters the prognosis, and improves the treatment. It is, no doubt, true that there are many other causes of hydrocephalus. Therefore, a parental history, as well as the appearance of the patient, should be carefully investigated. The fœtal brain may be affected by syphilis in two ways, giving rise to teratological hydrocephalus by arrest of development, or hydrocephalus by syphilitic lesions affecting the choroid plexus or the ventricular ependyma. In the later cases there is proliferation, not followed by fibrosis of the ependyma. Left to itself, syphilitic hydrocephalus is almost always fatal. Under treatment, it may recover. On the other hand, teratological hydrocephalus is unaffected by treatment. As it is sometimes difficult, if not impossible, to distinguish these two forms, the writer suggests trying anti-specific treatment in all cases. The treatment should be begun early, and carried out energetically, the best form being mercurial inunction. The children should be breast-fed by the mother. The recognition of syphilitic hydrocephalus should be the indication for prophylactic treatment in future pregnancies.

DIFFUSE POST-INFLUENZAL PARALYSIS.

PITRES describes a remarkable case in which an attack of influenza of moderate severity in a youth of twenty years was followed at the end of a month by progressive æsthenia (*Journ. de Med. de Bordeaux*, No. 41). The lower limbs became gradually weaker, until the patient was unable to stand. Weakness then appeared in the upper limbs, and the muscles of the neck and trunk. There was no pain or sensory disturbance; there was no muscular atrophy, and the general health seemed unaffected. Pitres remarks that if we except certain circumscribed forms of paralyses, such

as follow diphtheria or are caused by definite neuritis, there remains a well-defined series of paralyses occurring after infectious diseases. The series may be divided into four groups —(1) asthenia of convalescence; (2) diffuse asthenic paralysis (Grübler's); (3) sub-acute general paralysis (Duchenne); (4) Landry's disease. The first is of frequent occurrence, and consists in general feebleness without actual paralysis. Influenza is certainly the disease which induces it more frequently. It is quite common to meet with mild cases of influenza, after which the patient remains for days and weeks in an enfeebled condition, incapable of effort, but without any objective evidence of paralysis or lesion of the muscles. Appetite may recover, and the general state be satisfactory, except for the asthenic symptoms. This form of post-influenzal asthenia may last for a very long time. Diffuse asthenic paralysis of convalescence, ably described by Grubler, constitutes a more severe form. There is actual paresis, diffuse in character, and appearing rapidly in all the limbs, then in the trunk, and finally affecting all portions of the striate muscular system. There is neither pain nor muscular wasting; the electrical reactions are unaffected as a rule, and the sphincters escape. The prognosis is essentially good, and recovery may be expected in two or three months. That form called sub-acute paralysis, described by Duchenne, of Boulogne, is a more acute form, lasting longer and presenting a more serious prognosis. In the course of some days, or even weeks, a progressive weakness, first of the lower limbs, then the upper, and lastly the trunk, is noticed; even the face may be affected. While in the last there is a mixture of paresis and asthenia, there is in this form actual paralysis. The muscles early show evidence of atrophy; electrical reactions show qualitative changes; there is loss of the tendon reflexes; the sphincters escape. The evolution of the disease is painless; it takes a long time to reach its acme, then remains stationary for a time, subsiding slowly. Recovery is the rule, but the progress is slow. Intercurrent pulmonary conditions may appear and constitute a grave element in the case. Landry's disease, described in 1859, may be regarded as a grave form of post-influenzal paralysis. It is essentially

acute ascending paralysis progressing from below upwards, very liable to involve the diaphragm, and to end fatally by asphyxia or syncope. The whole course of the disease may last forty-eight hours, and rarely attains a duration of eight or ten days. This disease, again, consists in paralysis without muscular wasting, pain, or sphincter involvement. Although these four forms are a little schematic, they may be regarded as constituting a graduated series of increasing severity, and in the series there may be many intermediate cases. As a matter of fact, the clinical picture is very similar, the differences being in degree. There is always a diffuse motor weakness, constituting a common element in all four groups. Many pathologists describe the lesions as myelitic; at the same time, it is rare to find any evidence of coarse lesions in the cord. These cases are not to be confounded with others in which actual lesion, focal or otherwise, is present in the cord; nor again, with cases of true neuritis, which are distinguished from diffuse paresis by the essential phenomena of neuritis.

THE RELATIONS OF MEASLES AND TUBERCULOSIS.

GRESE gives the results of his observations on thirty cases observed at the Hopital des Enfants Malades (*These de Paris*, 1903) bearing upon the relationship between measles and tuberculosis. All latent cases of tuberculosis in children attacked by measles receive a marked stimulus, especially in early infancy. Not infrequently a caseous tubercular focus, such as may be found in the tracheo-bronchial glands, becomes a starting point of miliary tuberculosis. Declared tubercle, occurring at any age, is aggravated by measles, as the general resisting power of the patient is diminished, and the respiratory system in particular. Measles does not induce tuberculosis, as has often been supposed. It simply prepares the soil for the exhibition of the tubercle bacillus. Hence the importance of protecting children suffering from measles from every possibility of tubercular contamination. So far as measles is affected by tuberculosis, it may be remarked

that the period of invasion and eruption in early childhood tend to be shortened. The eruption is paler, and the temperature is higher; the pulmonary symptoms are also more marked. In later childhood, tuberculosis does not appear to impede the course of measles in the least degree.

THE COMPLICATIONS OF VARICELLA.

VARICELLA is, as a rule, so benign that complications are at once put on record, with the result that there is a long list of these, though they seldom occur. Lannois, of Lyons, contributes the following noteworthy (*Journ. de Méd et de Chir. Prat.*, March 10, 1904). Ulcerative and gangrenous eruption, hæmorrhage into the eruption in debilitated subjects, albuminuria, inflammation of the pleura and the serous surface of the joints, the lattter being either simple or purulent, pneumonia, pulmonary abscess, cellulitis of the neck, and suppurative parotidis. Sequelæ may be poliomyelitis and polioencephalitis. An important complication to which the writer particularly draws attention is the occurrence of ear lesions. Thus vesicles may form in the meatus, and possibly on the membrane, but the chief ear troubles are due to an extension upwards from the pharynx, especially should varicella affect children with large tonsils and adenoids. A possible result is the exacerbation of chronic otitis. Mastoiditis may also occur in those cases where chronic otitis takes on an acute form. At the same time, the writer points out that it is very exceptional for the ear to be affected in varicella, and that the vast majority of such cases occur in patients with some predisposition to inflammatory affections.

DOUGLAS STANLEY.

SEPARATION OF THE EPIPHYSES.

AT the French Surgical Congress of 1904 a discussion was held (as reported in the *Revue de Chirurgie*, November, 1904) on the subject of "Traumatic Separation of the Epiphyses." M. Kirmisson, in introducing the subject, reviewed the present state of knowledge of the etiology, morbid anatomy, complications, treatment, and prognosis somewhat briefly, without adding anything to what was presented by Poland

in 1898. He alluded to the value of the Röntgen rays in establishing the great frequency of these lesions, and in differentiating them from fractures and dislocations. This was emphasised by another speaker, M. Manoury, who reported a case in which the skiagram alone determined the diagnosis : A boy of ten years, who had fallen on the shoulder, presented all the signs of sub-coracoid dislocation ; the X-rays demonstrated displacement of the humeral epiphysis, however. Reduction was easily effected, five hours after the occurrence of the accident, by gentle traction without anæsthesia, the displacement righting itself abruptly, with the characteristic " snap " of the reduction of a dislocation. (This peculiarity has been noticed by Poland.)

M. Kirmisson stated that the etiology of separations of the epiphyses varies with the case. For the most part they are produced by indirect violence. In the case of the lower extremity of the femur, the separation is almost always due to torsion of the limb—the familiar cause being entanglement of the leg in the spokes of a revolving wheel—while direct violence to the shoulder is the common cause of displacement of the upper epiphysis of the humerus. Broca pointed out that the situation of the epiphysial line, whether intra-capsular or extra-capsular, is an important factor in the etiology. If extra-capsular, the epiphysis may be displaced by indirect violence ; intra-capsular epiphyses, however, can only be dislodged by the direct action of a blow.

The line of separation may follow exactly the line of the cartilage of the epiphysis, but in many cases it passes along this line for a part of its course and then traverses the extremity of the diaphysis as a partial fracture. In these latter cases the displaced epiphysis carries with it bony fragments which may produce impaction, or may greatly endanger the adjacent parts. The separation may occur by a fracture of the diaphysis close to, but not including, the conjugal disc.

Separation of the epiphysis may take place with or without displacement of the extremity of the bone—a distinction of great importance as regards the treatment and prognosis

of the condition. Condray and Cornil conclude, from the results of experiments carried out on the repair of epiphysial separations, that the process of repair of pure epiphysial separations and of fractures of the cartilage leads to the almost inevitable arrest of the osteogenetic function of the cartilage, and the subsequent impairment of growth of the limb. These injuries are not accompanied by displacement of the epiphysis. The reparation of (juxta-epiphysial) diaphysial fractures, which are generally marked by displacement of the end of the bone, is not associated with these unfortunate results.

M. Kirmisson finds that the lesion most frequently affects the lower extremity of the femur, the carpal end of the radius, and the head of the humerus. (In our experience the lower epiphysis of the humerus is more often affected than any other.) Grave complications arise in some cases of separation of the lower epiphysis of the femur, notably lesions of vessels and nerves, leading to gangrene and amputation. Reboul recounts two cases of this injury, on both of which operations were necessary. A child of seven years, whose leg had been caught in a moving wheel, presented himself with the epiphysis displaced forward and rotated (flexed) on its transverse axis, with the lower end of the shaft in the popliteal space. Replacement of the bony parts was only effected through lateral incisions; apposition was maintained by metallic sutures. The ultimate result was very satisfactory, the child being active and well two years later. In the second case a similar displacement occurred in a man of seventeen years, from direct violence, his knee coming into violent contact with a post when at riding exercise. The internal condyle carried with it a sharp bony fragment which threatened the popliteal contents, and the periosteum was widely stripped up off the shaft. The lower end of the shaft had pierced the joint capsule and vastus externus, and was fixed in the skin. Partial resection was necessary before reposition of the bony fragments could be effected, but sloughing of the skin on the outer side of the knee, and necrosis of the lower end of the shaft, necessitated amputation through

the thigh at a later date. The patient eventually survived.

M. Kirmisson emphasised the importance of considering the age of the patient and the site of the injury in arriving at a diagnosis of these lesions. He stated that generally there is a marked abnormal mobility, which is non-articular (a view with which we cannot coincide).

Separation of the upper epiphysis of the humerus is often associated with considerable displacement, the reduction of which is extremely difficult, and often necessitates resection of the upper extremity of the shaft. The displacement frequently simulates a dislocation—as in Manoury's case—and Walther said that in three cases in his own practice the signs presented were those of an old dislocation of the shoulder. Walther, Roux, Poncet, Monprofit, and others cited cases of separation of the upper epiphysis of the humerus in which it was necessary to resect a portion of the diaphysis to effect reduction of the displacement.

As to the ultimate results of separation of the epiphyses, M. Kirmisson quoted M. Curtillet, who had collected only twenty-four cases of arrested growth of a limb subsequent to this lesion, in support of his view that impaired growth was much less frequent than would, *a priori*, have been expected. Certain epiphyses are more important than others in respect of the elongation of the bones: it is in the cases of these "fertile" epiphyses (at shoulder, wrist, and knee) that some impairment of growth may be expected to follow injury.

Froelich gave three instances of separation of epiphyses in which signs of nerve injury and impairment of growth developed. The first was a child of fifteen months, in which there was marked displacement of the lower end of the radius, with "radial paralysis" and 1½cm. shortening. The injury occurred at birth. The second was a case of separation of the upper humeral epiphysis which, after two years, in a child of five, had caused a paralysis of all the muscles of the shoulder, and a flail-joint and 3cm. shortening of the arm. (The case presents a picture which suggests the diagnosis of Erb's palsy.) The third was a girl of nine years, who had been treated for a dislocation of the shoulder, in

whom, four weeks after the accident, paralysis of the forearm was present. Improvement set in after resection of the upper extremity of the shaft of the humerus.

Bardesco recounted a case in which the lower epiphysis of the tibia had been displaced at the age of two years, and was not reduced. Fourteen years later there was a deformity consisting of a bending inwards of the lower third of the leg, with 6 cm. of shortening of the bones of the leg. A compensatory lengthening of the femur of 5 cm. was present.

It is interesting to note the omission of any reference to separation of the upper epiphysis of the femur in this discussion. This lesion has attracted considerable attention both in America and in England recently in connection with the subject of coxa vara of adolescence.

A. W. NUTHALL.

ANIMAL EXPERIMENTS ON SPINAL ANÆSTHESIA.

By W. J. McCardie, B.A., M.B., B.C. Cantab.

Eden (*Deutsche Zeitschrift für Chirurgie, Band* 67—*Festschrift zur Geburtsfeier von* Prof. Dr. Friedrich v. Esmarch) has recorded some good work on this subject. He has tested several drugs.

At the suggestion of Prof. Bier, Eden has made many experiments on animals. After a time he used only full-grown cats. The rabbit is too "indolent," and one cannot be sure of puncturing its lumbal sac, for the needle very easily enters the bone. Dogs were not available. Eden punctured just above the last or last but one vertebra. The outflow of fluid was not always observed, and cannot be regarded as a certain event, and need not be so looked upon even in man. *Post mortem* examination revealed proper puncture. Anæsthesia is the test of puncture. The syringe held 1 c.c. All operations were conducted with surgical cleanliness. As tests of anæsthesia were used pointed needles and the red-hot Pacquelin's cautery. The needle test was very unreliable, and the latter was not always sure. Operations were at times done as tests. Infection never

occurred. The eucaine was boiled after being dissolved. Several times the cocaine solution was boiled without losing its power. The author believes cocaine to be very variable in its action; therefore great care must be taken to get a good drug from first-class firms. The reasons for the changes in cocaine are unknown. The temperature of healthy cats varies usually between 37.7°C. in the morning and 38.7° C. in the evening on an average.

COCAINE.

Cocaine, even in very small doses, produced an excellent anæsthesia. Eden could obtain this with 0.0005 in 1 c.c. of water, so that the exposed sciatic nerve could be touched with a hot Pacquelin's cautery. No symptom of poisoning or concurrent effect ensued. The fatal lumbar dose of cocaine is about 0.018 for cats. If occasionally animals can bear gradual injection of doses up to 0.05 and 0.063, it corresponds to the generally known fact that several small doses act less harmfully than one big one. Subcutaneously, the fatal dose is yet higher. After 0.1, animals died with symptoms of poisoning in three and twenty-two minutes respectively. The picture is typical—wide pupillary dilatation, enormous salivation, rapid respiration, and clonic spasms. With Schleich's solution a very good anæsthesia was obtained, so that a leg could be amputated with 0.001. The fatal dose was 0.01. The author could not see any advantage in Schleich's mixture.

There is no doubt that poison injected into the lumbal sac very quickly extends, and to a greater or less extent spreads upwards, and is not carried by the circulation of the blood to the brain and medulla oblongata in order to produce a fatal effect, as otherwise one could not understand why a dose which can be given *subcute* should be so much greater.

In order to retard the injected fluid as much as possible in the lumbal sac, rubber bandages were put round the cat's neck. The idea was to increase the blood pressure in the brain, and through the contraction of room in the skull cause the cerebro-spinal fluid to be pushed back into the lumbal sac, or to hinder the quick ascension of the injected liquid up through the cerebro-spinal fluid which was under

increased pressure. The author believed that he succeeded in this object. One animal bore without a symptom of poisoning 0.01 when the neck was bound. When, three-quarters of an hour later, 0.01 was again injected without the neck-band, at once marked salivation occurred, the pupils widely dilated, respiration became very quick, slight clonic spasms appeared, and also tossing of the head. Doses of 0.02 and 0.04 were borne without hurt when the neck bandage was applied.

Changes of temperature which can be referred solely to the effect of cocaine could not be so regularly observed as in the case of dogs tested by other authors. With small doses, *e.g.*, 0.0001, they were absent. No advantage was seen from a solution of cocaine in 0.2 per cent. saline solution. With a larger quantity of the solvent, anæsthesia extended higher than with a smaller quantity.

Eden confirms the good effect of amyl nitrite in cocaine poisoning. With an injection of 0.02 and 0.04, the animals remained alive and showed only moderate symptoms of poisoning when they were made to inhale amyl nitrite. No advantage appeared in a solution of cocaine in alcohol; on the contrary, the concurrent paralysing effect of the alcohol was observed.

COCAINE B-EUCAINE MIXTURE—EQUAL PARTS.

The above mixture was tried in order to compensate the anæmia brought about by cocaine by the hyperæmia produced by eucaine. The anæsthetic effect of the mixture was prompt with 0.0001, and especially marked about the front of the body and even in the head. On the other hand, anæsthesia quickly disappeared, mostly after twenty minutes. In one case a remarkable rise of temperature, up to 40.3° C., was seen for a day. Death occurred after injection of 0.01—0.018 in seven to ten minutes.

B-EUCAINE.

No advantage of b-eucaine in lumbal anæsthetic effect could be observed. Anæsthesia occurred on injection of 0.005 and twice with 0.00175 and 0.0001. The temperature changes varied just as in the case of cocaine. The fatal dose lay between 0.036 and 0,018. Thus the comparative

fatal and anæsthetic doses of cocaine or b-eucaine show to the disadvantage of cocaine.

SALINE SOLUTIONS.

Injection of 1-9 c.cm. of 2 per cent. saline solution produced good anæsthesia twice for one hour without concurrent effects or change of temperature. Following Schleich, 1 c.cm. of 0.2 per cent. solution was injected, and anæsthesia obtained as far as the pelvic cavity, disappearing in fifteen minutes. Positive results are much more valuable than negative ones. The effect of the 0.2 per cent. solution, the author believes, is due to the œdematising of the nerves, as one actually finds in each section of a lumbally-injected cat that these nerves are œdematously swelled, and this condition extends the higher the larger the amount of fluid injected. This view is supported by the fact that in the human being 0.2 per cent. salt solution is a failure. In man the injected fluid mixes at once with a large quantity of cerebro-spinal fluid, which is always present in the wide lumbal sac, and correspondingly large enough injections have not been tried. It is different with a cat. It can well be imagined how, with a high pressure, the nerves are permeated with fluid in the narrow lumbal sac, especially as it is partitionless. Perhaps the pressure on the nerves themselves suffices to make them ischæmic, and thus to paralyse power of conduction in the easily-influenced sensory fibres. Next the difference in temperature between the solution and the body would come into play. Schleich asserts in his book that his solutions of small concentration are considerably weakened in their effect at the body temperature, and that at a higher temperature the effect altogether disappears. Perhaps the power of cocaine in producing anæmia may be the chief reason of its anæsthetic power in the lumbal canal, apart from the fact that cocaine manifestly has a, so to speak, specific effect of its own on the sensory nerve substance. The hyperæsthetic effect of stronger saline solutions, which Schleich first established, Eden confirms. After injection of 1 c.c. of a 10 per cent. saline solution subdurally, he observed undoubted hyperæsthesia, which lasted some time. The strong solution has no injurious effect on the animal.

Carbolic Solution.

The anæsthetic effect of carbolic solutions is well known. 1 c.c. of a 5 per cent. solution produced an excellent anæsthesia up to the level of the pelvis, so that operation on the leg could be performed. The effect lasted half an hour. The other leg was paretic, but recovered on the fourth day. After the injections, clonic convulsions were seen in the hinder parts. No special increase in temperature was observed, and the spinal cord showed no particular microscopic change.

With solutions of 0.1 to 3 per cent. the author obtained no result at all, or only a slight one. After injection, symptoms of irritation almost regularly appeared in the hind legs. The injections were not painful. The hind legs were always slightly paretic. One animal died inexplicably.

The early signs of irritation, and also the passing paretic effects, with a 5 per cent. solution forbid experiments on man. The weaker solutions gave too bad results on animals to justify further trial.

Morphine.

The result was negative. With small doses of 0.001 to 0.01 the central nervous function was not affected. With larger doses of 0.03 to 0.05, and even 0.1, undoubted hyperæsthesia occurred, and with it marked salivation.

Nirvanin.

Small doses, as 0.005, had no effect. With 0.02, painless amputation of the leg could be performed. With doses of 0.05 and 0.06, death at once occurred, without any special symptoms. The fatal and anæsthetic doses were so close together that nirvanin would be dangerous for lumbal anæsthesia.

Peronin.

With peronin, 0.01 produced good anæsthesia. With 0.005 was obtained useful anæsthesia, which, however, did not last long. Here also it was apparent that with a larger quantity of the solution anæsthesia extended higher. No special concurrent symptoms were seen. The fatal dose on the lumbal sac is about 0.05. In rabbits, after 0.1 *subcute*,

death quickly occurred, with appearance of clonic spasms, quickened respiration and salivation. With half this dose, death took place in thirty minutes with the above symptoms. A rise of temperature was several times observed.

ACOIN.

With .5 mg., very good anæsthesia was obtained, which allowed of painless amputation. The fatal dose lay between 0.01 and 0.05. Death took place without spasm or salivation, the breathing becoming slower and lighter. Rise of temperature solely due to the action of the drug was noted in one case. The difference between the anæsthetic and fatal dose of acoin is far greater than it is in the case of cocaine.

HOLOCOCAINE.

Doses of 0.01 and even 0.001 produced good anæsthesia. In the latter case it did not last long. No special symptoms of poisoning were observed. A dose of 0.03 killed at once. Further trials, therefore, did not seem necessary.

ANÆSTHESIN.

Good, but only short, anæsthesia was obtained with 0.0075, without any complications. With all alcoholic solutions good anæsthesia followed, but resulted in a more or less lasting paralysis of the hind legs. An oil solution did not cause anæsthesia, but produced paralysis which did not disappear for two days. The fatal dose is between 0.036 and 0.08—0.1. Anæsthesin doubtless kills chiefly by paralysing the respiratory centre, as experiments show. In one case the animal was revived by artificial respiration after injection of 0.12 anæsthesin. The symptoms of poisoning are narrow pupils and clonic spasms.

TROPA-COCAINE.

Two experiments were made. With 0.02 a good anæsthesia, lasting three-quarters of an hour, was obtained. Afterwards a certain heaviness in the hinder parts was noticed, which, however, may have been due to other conditions. With a dose of 0.01 a transitory moderate anæsthesia was produced. A decisive opinion cannot be given from these two experiments.

Tinctura Opii Simplex.

A dilute solution in water was used. The anæsthesia obtained by small doses was short. Once there was distinct weakness in the hinder parts. With larger doses, pure opium narcosis was observed in one experiment, which the animal bore well. On the other hand, symptoms of poisoning, such as motor unrest increasing to clonic spasms or dyspnœa, and spasms of extension, leading to death, were noted. The result did not encourage further trials.

Ether.

Experiments were made in the belief that the power of ether to dissolve fats might perhaps be of importance. With small doses serviceable results were obtained. Large doses caused after-paralysis, or marked collapse, in which either artificial respiration produced good effect or death occurred.

Alcohol.

Alcohol in 10 per cent. solution gave good anæsthesia, with only passing paralysis or none at all. Greater concentrations left long-lasting paralysis. Good anæsthesia, however, was obtained with 24 per cent. and 48 per cent. of alcohol in small quantities, and without any injurious after-effect. One injection of 96 per cent. of alcohol produced excellent anæsthesia, which, however, was accompanied by collapse and followed by lasting paralysis. Larger doses resulted in death. As already mentioned, there were seen no advantages in a solution of cocaine in alcohol. The transitory paralyses were regarded merely as disagreeable complications.

Chloroform.

With this drug no anæsthesia was obtained. (N.B.—only one experiment was performed.—W.J.M.)

Distilled Water.

Very good anæsthesia was obtained by the injection of two to three syringefuls of distilled water. One syringeful had no effect. Ten syringefuls produced anæsthesia up to a much higher level. The injections were not painful, so far as could be observed. The author thinks that anæsthesia is produced by infiltration of the nerves issuing from the cord, just as in the case of the saline solution.

REPORTS OF SOCIETIES.

BRITISH MEDICAL ASSOCIATION.

BIRMINGHAM AND MIDLAND COUNTIES BRANCH. PATHOLOGICAL SECTION.

THE third meeting of the Session was held on January 27, 1905, Dr. Foxwell in the chair.

Transposition of Viscera.—Dr. Short showed a skiagraph of a man aged twenty-seven (unfortunately unable to be present himself on account of a recent attack of pleurisy), which showed transposition of the heart and liver. The spleen was also transposed, but this was not clear in the skiagraph. Dr. Short hoped to show the man himself at a future meeting.

Mr. Frank Barnes showed a case of rodent ulcer in a woman, which had existed five years, and had once been unsuccessfully treated with X-rays. The ulcer healed after about eighteen applications, with the exception of two small areas, which involved bone in one case and cartilage in the other. Altogether, about forty applications of the rays had been used, but spots remained intractable. They show the necessity of some surgical aid where a rodent ulcer is deep, such as scraping, treatment with acid nitrate of mercury, etc., before proceeding to the treatment of X-rays.

Dr. Lamb showed two cases of nasal disease—(1) a boy of thirteen years, in whom the left nostril was almost completely blocked by bony growth. The lower and middle spongy bones were very greatly enlarged; the space between the eyes was very much increased, especially on the left side; and that part of the frontal bone which overhangs the inner canthus was markedly thickened and convex. The process affected chiefly the left ethmoid and the left inferior spongy bone, but the frontal bone was affected to some

extent on both sides of the middle line. The right nostril was normal to inspection. The patient suffered no discomfort whatever, and was even able to sleep quietly with his mouth shut, the right nostril being roomy. The process had lasted at least three or four years, but its beginning was unnoticed.

Messrs. Billington, Lucas, and Heaton discussed the case, and suggested that its main features agreed with those of leontiasis ossa.

(2) A woman of forty-eight, with bony overgrowth in the right nostril. The enlargement affected chiefly the lower spongy bone and the unciform process, but the lateral mass of the ethmoid was also affected to some extent, as the space between the eyes was increased. The posterior part of the unciform process was apparently inseparably blended with the middle turbinated body. Large masses of moriform hypertrophy had been removed from the lower spongy bone. The nostril was very roomy. Bony enlargement of the unciform process was unusual in the absence of suppuration, and it was also rare to have the lower spongy bone affected simultaneously.

Dr. Douglas Stanley showed a child, aged ten years, admitted under his care at the Children's Hospital on account of pains in the hands and arms. She was under-developed and wasted, and had been treated a year previously at the same institution for Raynaud's disease. The lesions present now were deformity of the hands of the type of rheumatoid arthritis, abnormal firmness of the skin, resembling scleroma, and undue hardness of the limb muscles. Dr. Stanley discussed a possible relationship between these conditions and Raynaud's disease.

Dr. Sydenham showed a boy, aged sixteen years, who came under his notice two months ago on account of sudden loss of sight in the right eye and nose-bleeding. Examination showed undue prominence of the right maxillary antral region. The left eye became blind subsequently. Pupil reflex was lost in each, but there were no changes to be found on ophthalmoscopic examination. Dr. Sydenham believed the

case to be sarcoma involving the bones in the neighbourhood of the sphenoid.

Cystic Kidneys.—Dr. Foxwell showed these. They weighed 20oz. and 22oz. each, and were taken from a man of forty-four years, who, up to the time of his admission to the Queen's Hospital, two months prior to his death, had never had any illness, though he had spent ten years of his life as a soldier in India, and had drunk heavily. For the last twelve years he had been a bricklayer's labourer. The urine resembled that of granular kidney, except that it had a larger quantity of albumen, and the diagnosis made was mixed small kidney. Neither organ was felt during life, and, *post mortem*, they were found unusually fixed and high up, so that their lower extremities barely came below the margin of the ribs.

Alcoholic Heart.—The patient was a cook, aged thirty years, who came into the Queen's Hospital under Dr. Foxwell's care for painful palpitation and dyspnœa, with anasarca below the diaphragm. Throughout his stay in hospital palpitation and dyspnœa were the chief symptoms, and the whole præcordium showed a somewhat powerful pulsation of an irregular, wave-like character. There were no murmurs, except an occasional functional mitral. The diagnosis never got beyond the main fact of myocardial failure. It was thought on the whole that the condition was a mixed one of fatty and fibroid change. *Post mortem*, osmic acid gave no sign of fat, nor was there any definite fibroid degeneration seen under the microscope, but transverse striation was almost absent, though the longitudinal was distinct; in places the fibrillæ were swollen, and then showed constructions resembling imperfect transverse striation. Microscopically the wall section was pale, but of good consistence, and in no other way abnormal.

Chronic Ulcer of Stomach with Perforation.—Dr. Short showed the stomach, liver, and pancreas from a man aged fifty-five years, who had died somewhat suddenly from perforation of a chronic ulcer of the stomach. He had had pain and vomiting for about nine months before coming under observation. The stomach was dilated, but the pylorus,

which was much thickened, had not been constricted sufficiently to prevent the passage of food from the stomach into the duodenum. There was absence of free hydrochloric acid in the vomit. The most interesting point about the case was that for sixteen days before the perforation occurred he had been quite free from pain and vomiting, was taking a middle diet with fish, and getting about comfortably. At the same time, he was gradually losing flesh. The base of the ulcer was formed by pancreatic tissue. As no microscopical section had been made, it was impossible to say whether the extreme thickening about the pylorus was cancerous or not.

BIRMINGHAM BRANCH.

THE fifth ordinary meeting of the Branch was held on Thursday, February 9th, at the Medical Institute, at 8-30 p.m. In the unavoidable absence of the President, the President-elect, Mr. T. F. Chavasse, took the chair. There were twenty-nine members present.

The minutes of the last meeting were read, confirmed, and signed.

Mr. George Heaton read a paper entitled "Appendicitis during pregnancy, and some peculiarities of the disease in the female sex," under the following headings:

Comparative infrequency of the disease in women. Appendicitis during pregnancy. Its high mortality. Frequency of miscarriage and abortion. Factors in prognosis, with illustrative cases. The urgency of immediate operation in all cases. Question of induction of abortion. Statistics.

Appendicitis as a cause of Right-sided Pelvic Inflammation. Methods of extension of the disease to the uterine appendages. Liability to recurrence at menstrual periods. Illustrative cases.

Points in the Treatment.

The paper was discussed by the President, Drs. Taylor, Kirby and Lydall, and Mr. Heaton replied.

Dr. Carter then read a paper entitled "An unusual type of fever resulting from animal bites," illustrated by two cases. Mr. Leedham Green, Drs. Kauffmann, Melson, and Heath, discussed the paper, and Dr. Carter replied.

MIDLAND MEDICAL SOCIETY.

A MEETING of this Society was held at the Medical Institute, Birmingham, on January 18, the President, Mr. Wood White, being in the chair.

Mr .Barling showed (1) a patient from whom he had successfully removed a tumour of the cerebrium; (2) a man who had been the subject of migraine of twenty years' standing, who was cured by the fixation of a movable kidney; (3) a specimen of advanced hydronephrosis in a movable kidney removed from a woman, aged fifty years, who had suffered pain, more or less severe, for twenty years, but more severely during the last twelve months. The other kidney was also freely displaced downwards, but was not hydronephrotic.

Mr. Gamgee showed (1) a women, aged fifty-one years, who for seven years had suffered constantly from very severe headaches, which had resisted all ordinary forms of treatment. Fixation of a right movable kidney had resulted in complete cure of the headache. (2) A large hydronephrosis removed from a woman, aged forty years. The patient had suffered from a movable kidney for twenty years, and the hydronephrosis was apparently the direct result of the mobility.

Mr. Barling read a paper on "Renal Mobility and its Treatment.

A MEETING of this Society was held at Birmingham on February 1, the President, Mr. Wood White, being in the chair.

Dr. Emanuel showed a case of spina bifidia occulta in a child aged two years. In the dorsi-lumbar region of the spine there was a diffuse overgrowth of long hair. The vertebræ covered by this hair seemed in no way defective, but lower down the spine, at the juncture of the coccyx with the sacrum, there was evidence of incomplete closure of the primitive medullary groove in the form of a well-marked dimple in the middle line. The child, otherwise perfectly well

developed, suffered from incontinence of urine, but this was held not to point to any defect in the cord, as there were no other signs such as talipes, altered knee-jerks, etc.

Mr. George Heaton showed a specimen of sarcoma of the epididymis removed from a man, aged twenty-eight years, who had noticed a tumour at the back of the right testicle for eight weeks. It increased rapidly in size at first, but latterly had not enlarged much. The testis could be felt in front of the lower part of the swelling. The tumour on removal was about the size of a large orange. The testis—normal in size and appearance—was situated at the front part, and not involved in the growth. There was no enlargement of the vas deferens or other constituents of the cord. Microscopically, the tumour was a mixed round-celled and spindle-celled sarcoma.

Dr. Stanley Barnes showed specimens from a case of cerebral tumour, in which there was secondary growth in the spinal pia mater. The patient was a boy, eleven years of age, who two years previously had suffered from morning vomiting, slight headache, and progressive loss of sight. After an illness lasting about six weeks, all the symptoms abated, and his eyesight improved sufficiently for him to be able to read large print. The symptoms recurred two months before admission to the Queen's Hospital, the patient having been practically well during the interval. In hospital he grew gradually worse, his main symptoms being headache, vomiting, loss of sight (due to post-neuritic atrophy), wasting and convulsions. All the reflexes were lost several weeks before death. *Post mortem* there was found a large sarcoma of the frontal lobe, apparently growing from the ependyma of the anterior cornu of the lateral ventricle. The floor of the fourth ventricle, and parts of the other ventricles, showed secondary growths, and at the base of the brain and around the spinal cord the piamater (and to a less extent the arachnoid) were enormously thickened to form an almost continuous mass of sarcomatous growth, forming a sheath for the spinal cord. The posterior root ganglia, and some of the roots of the cauda equina, were greatly enlarged by growth.

The secondary affection of the ventricular walls and pia mater probably occurred as a result of rupture of the tumour.

Dr. Douglas Stanley read a paper on "Syphilis of the Lungs." He dealt with the difficulties of diagnosis from tubercular phthisis, and pointed out the importance of recognising syphilitic disease in order to apply a proper treatment.

KIDDERMINSTER MEDICAL SOCIETY.

A MEETING of this Society was held on Friday, February 3, Mr. J. L. Stretton in the chair.

Cases and Specimens.—Mr. Stretton showed :—

(1) A man, aged forty-two years, whose wrist he had excised for tubercular disease. The whole of the carpus, the ends of the metacarpal bones, and the ends of the radius and ulna were removed through a single dorsal incision. The result was satisfactory; within two months of the operation he was able to use a spade.

(2) A man, aged seventy-five years, who fractured his patella transversely. It was brought together with wire, after the method of Mr. Barker, and he was able to walk about in ten days.

(3) A woman, aged thirty-five years, treated successfully with Professor Selwo's serum for anthrax.

(4) A dermoid cyst of the right ovary, removed from a maiden lady aged fifty-three years. It contained a large mass of hair, and fixed to the upper end of the cyst wall was a portion of bone resembling an upper jaw with a row of six teeth.

Dr. Bertram Addenbrooke showed temperature charts of three cases of pneumonia under his care in one week, all following influenza. One subsided by lysis, and two by crisis. (2) An aural polypus. (3) A large cancerous tumour, removed from the abdominal wall. (4) A large mushroom-shaped, phosphatic, vesical calculus which had formed in a vesico-vaginal fistula, which resulted from the operation for vaginal hysterectomy.

Mr. A. C. Oldham read a paper on "Peripheral Neuritis." He described at considerable length a case he had had under his care, complicating pregnancy. The child was born at full time, and was healthy, and the mother made a good recovery.

Some new ethical rules having been adopted, the meeting terminated.

BOOKS RECEIVED.

From J. and A. Churchill, London—

Guy's Hospital Reports. Vol. LIX.

The Infectivity and Management of Scarlet Fever. By W. T. GORDON PUGH, M.D.

From Cassell and Company, London—

The Open-Air Treatment of Pulmonary Tuberculosis. By F. W. BURTON-FANNING, M.D.

From Baillière, Tindall, and Cox, London—

Pulmonary Consumption. By ARTHUR LATHAM, M.D. Second Edition.

Autobiography of FREDERICK JAMES GANT, F.R.C.S.

Lateral Curvature of the Spine. By RICHARD BARWELL, F.R.C.S.

From the Scientific Press, Ltd., London—

Elements of Anatomy and Physiology. By W. BERNARD SECRETAN, M.B.

Burdett's Hospitals and Charities, 1905.

An Elementary Treatise on the Light Treatment for Nurses. By J. H. SEQUEIRA, M.D.

From the Medical Times, Ltd.—

The Chief Operations of Ophthalmic Surgery.

From Felix Alcan, Paris—

Le Traitement de l'Hypertrophie Senile de la Prostate. By A. GUEPIN, M.D.

SOME OBSERVATIONS ON UNDUE RENAL MOBILITY AND ITS TREATMENT.*

By GILBERT BARLING, M.B., F.R.C.S., *Professor of Surgery in the University of Birmingham, and Surgeon to the Birmingham General Hospital.*

THE subject of renal mobility has of late years frequently been under discussion, sometimes with a great deal of acrimony and with little of the spirit of philosophy which should characterise those who are only desirous of arriving at the truth. In this room, within quite recent times, I heard it asserted by one who had ample opportunity of examining the abdominal cavity, both from within and without, that movable kidney was a rare condition, and that when it occurred it had no clinical or pathological importance. There are others who maintain an extreme opposite view, who describe undue movement of the kidney as very common, and ascribe to it great importance in the production of ill-health. It may be that the truth lies somewhere between the two extremes, and I will endeavour in what I have to say this evening to keep my remarks unbiassed and unprejudiced, and to present the subject to you as it has impressed me from my own experience. I have only one more general observation to make before coming to close quarters with my subject. It is to remind you that renal mobility is not a recent discovery in the sense that acute pancreatitis is, or malformation of the ureter. When thinking over the remarks I should place before you this evening, I recalled a chapter on movable kidney by Sir William Roberts, of Manchester, in his admirable book on "Urinary and Renal Diseases," which I first became acquainted with when reading for my degree in Medicine. This article was written about thirty years ago. Like all the productions of the author, it is a most careful and lucid description of the

*An Address delivered at the Midland Medical Society, January 18, 1905.

subject treated, and, though we may now add some few details, in all essentials the article might stand as he wrote it with little to cavil at, though, of course, at the time he wrote surgical treatment had not been attempted.

Before speaking of the frequency with which undue renal mobility occurs, it is necessary to agree upon what is meant by the term. There is a certain degree of renal movement which appears to be natural. This is easily to be made out at operations on the abdomen or in such as involve the opening of the loin. In either case, before the connections of the kidney are disturbed, it will generally be found possible to produce a downward movement of the organ of about an inch, somewhat more on the right side than on the left. The extent of the movement developed at the time of external examination will depend a good deal upon the depth of the patient's inspirations. In people of spare habit, this natural movement may bring the lower pole of the right kidney just within the reach of bi-manual examination when deep inspirations are taken, but the organ cannot be grasped and retained, or, if it is, then I submit it is unduly movable.

Adopting this as my criterion, I would express the opinion that undue renal movement is a very common condition, especially in the female sex, but occurring in males much oftener than is generally believed. I have no statistics to offer in support of my statement. *Post mortem* records are usually silent on the point; the pathologist has his attention fixed on other matters. Even were it otherwise, the condition of the fat surrounding the kidney varies so much when the living tissue is compared with the dead as to discount any observations made in the *post mortem* room, unless mobility is present in a high degree.

My opinion, then, is a clinical one, formed from the examination of many patients, some of whom were under investigation for suspected renal movement, others for quite different conditions; and in the course of abdominal operations I have frequently been able to confirm, or occasionally to correct, the opinion I have formed concerning the position of the kidneys made at the prior examination.

If renal mobility is not to be overlooked, the condition must be investigated systematically; and if the first examination does not reveal undue movement, and there is reason on other grounds to suspect it, the examination should be repeated. Personally, I always begin the examination with the patient lying on the back and the thighs flexed, but not by the pateint's own efforts, but by that of an assistant. The left hand is used to investigate the right side, and the right hand to investigate the left side, the palm of the hand being pressed firmly against the lumbar muscles immediately below the last rib, and the thumb lying on the front of the abdomen, close to the costal arch, so that the hand can grasp the patient's side. The patient is now told to take two or three deep inspirations, and at the second or third effort, whilst the palm pushes firmly up from the back, the thumb follows the retreating abdominal muscles at the beginning of expiration and when the expiratory act is completed if the kidney is movable, it may be found either in the grasp of the examining hand, or quite below it and palpable by the hand which has hitherto not been concerned in the examination. If the kidney is not detected in this way, a bi-manual examination should be made in the semi-prone and in the knee-elbow positions. Finally, the condition of the kidney should be investigated in the upright position, one hand pressing firmly into the loin from the back, the other being used on the front of the abdomen, the patient leaning slightly forwards and resting the hand of the side under examination upon some support. It is important to examine in this position, because there are some kidneys which do not reveal their displacement until the patient is vertical; or if the kidney is already found to be displaced downwards in one of the previous examinations. it will not infrequently be found to come lower down when the patient is in the vertical position.

I would like here to mention a case sent to me at the General Hospital by Dr. Orton, of Coventry. The patient had attacks of pain which might be described as mild colic on the right side of the abdomen, the pain being felt through to the back. I examined this woman several times in the

horizontal position, and on no occasion could I feel downward displacement of the kidney, and I therefore opened the abdomen, suspecting the presence of gall stones, but found the biliary apparatus quite healthy. Passing my hand up to the kidney, I found I could easily bring the organ downwards until it reached the upper part of the iliac fossa; the anterior wound was closed, and the kidney fixed through a lumbar incision, with relief to the symptoms. This woman had an unusually deep renal fossa, and subsequent experience tells me that if I had examined her in the erect position the renal mobility would probably have been discovered beforehand.

If the kidney is unhindered, it often returns to the shelter of the upper loin with the expiratory act; this is the expiratory return, but in many cases the organ fails to return, especially in the vertical position. Stress has been laid upon this expiratory return as of importance in determining whether operation shall be advised or not; if the kidney does return, operation has been described as unnecessary. With this opinion I do not agree; the criterion should be the amount of pain or other inconvenience to which the mobility of the organ is supposed to give rise.

Occasionally, during the course of a general investigation of the abdominal organs, movable kidney may be found of which the patient knows nothing, and no symptoms can be attributed to the mobility of the organ. I take care in such cases not to inform the patients, lest they should imagine themselves to be the subjects of disease, or, at all events, of a displacement which has a pernicious influence on their lives. Putting these cases aside. I will endeavour to classify the remainder into groups according to symptoms.

The first group, in which fairly-marked local symptoms occur, is a considerable one. In their severest form these symptoms, which are sometimes described as renal crises, may very well be regarded as attacks of renal colic; there is pain in the lumbar region, both in the front and in the back of it, pain which descends the ureter; vomiting; local tenderness, which may be extreme, hæmaturia, and occasionally

slight pyuria. These severer symptoms are generally associated with hydro-nephrosis, which may vary from a minor degree of dilatation, which can only be recognised when the organ is fully exposed in operation, to such extreme dilatation of the pelvis, with atrophy of the kidney substance, as may reduce the organ to a mere thin shell of secreting tissue. I do not wish to go at length into the origin of hydro-nephrosis, but I am satisfied that mere mobility of the kidney is in some cases an efficient cause of the dilatation of the pelvis, though no doubt hydro-nephrosis, especially one which intermits, is also a cause of renal mobility, and in such cases malformation of the ureter may be the first step leading to the dilatation of the organ and to its undue movement. In the diagnosis of these cases with severe attacks of colic, there are two conditions which may be difficult to differentiate from mobility of the kidney. The one is gall-stone colic, from calculi in the gall bladder, which never leave that organ, and so jaundice is never associated with the attacks. The other condition is relapsing appendicitis, with the appendix running high up behind the colon until it may reach over the front of the kidney.

More common than these severe cases are those in which the local symptoms are less intense, but perhaps more constant, and appear to me to be responsible for a good deal of ill-health and disability. These symptoms are, first of all, pain, never approaching the acuteness of renal colic, but very often present; it is of a dragging character, and occasionally associated with nausea. The patients are easily tired on exertion, and feel unable to discharge their duties in life. Recumbency gives relief, and after resting such patients are able to gird themselves up afresh to their work, but the old feeling of tiredness soon returns. In women there is unusual discomfort at the menstrual epoch, and at such times the kidney, when palpated, may be found to be larger than at others. A not infrequent cause of complaint is that, when in bed, they can only lie on the back, and are uncomfortable if they turn on to the side opposite to that on which the kidney is movable; or if both organs are movable, they may not be

able to lie on either side because of the dragging, rather sickening discomfort then experienced. Another of the inconveniences suffered is frequent desire to micturate, which is generally relieved by assuming the recumbent position; with this condition, slight hæmaturia, perhaps only detectable by the microscope, may be recognised.

So far I have referred only to what may be called local symptoms with some degree of neurasthenia at times associated; but I have next to mention a condition occasionally associated with undue renal movement in which local symptoms are absent or, at all events, unimportant: this is intense migrainous headache. Do not imagine that I am suggesting renal mobility as the explanation of all migraines; but I cannot disregard it as, at all events, an occasional cause.

This was first impressed upon me by a case under the care of Dr. Jordan, of King's Norton—a lady between thirty and forty years of age, whose chief trouble was migrainous headache, which incapacitated her from her household duties and rendered life absolutely miserable. This patient was seen by Dr. Suckling, and he, recognising free downward movement of the right kidney, advised fixation of the organ, and the patient was referred to me for this purpose. As the local symptoms were not at all marked, I hesitated to perform fixation, as I thought that the headaches were to a great extent neurasthenic, and that the nervous strain of going through the operation might make the patient worse rather than better. As an alternative I urged a prolonged rest in bed, the patient giving up the management of her house and children, and taking life as easily as possible. Neither when the patient was resting nor afterwards was she benefited. Finally, rather against my own judgment, I undertook the operation of nephrorraphy, and found a very movable kidney, with considerable hydro-nephrosis and atrophy of the kidney substance. Fixation of the kidney was performed through the oblique lumbar incision, and, I am glad to say, with remarkable benefit. The migraine has been practically cured, and the patient has been restored to her home life,

the duties of which she discharges with comfort and satisfaction, and the relief appears to be permanent, for it is now nearly four years since the operation was performed.

A similar case was under my care at the General Hospital ten months ago. The patient, a male, was the subject of migrainous headache, with an intense feeling of epigastric dragging and emptiness, which prevented him undertaking his duties as a gardener, and in consequence he had to accept a post as caretaker in a building to enable him to eke out a living. The headaches were periodic, generally once a week, and the patient feared he would become insane the pain was so severe; with the headache there was always a feeling of great depression. His right kidney was freely movable, and, having in my mind the case I have just related, I undertook, at Dr. Suckling's request, to perform fixation of the kidney. This was done on March 23, 1904, since which time the severe headaches have disappeared, the patient has had no headache at all, and he has sufficiently benefited by the operation to enable him to undertake any ordinary duties, and you see him here to-night, bright, cheerful, and alert—an entirely altered person, thankful to be rid of a condition which has made him miserable for seventeen years. One inconvenience he still has, viz., suppuration round a deep suture of silkworm gut, which will eventually come away.

In the two patients to whom I have just referred, headache was their great trouble. It is quite often associated with movable kidney, but rarely in an intense degree. In its mild form, when associated with pain, dragging, depression, it is very generally relieved by kidney fixation.

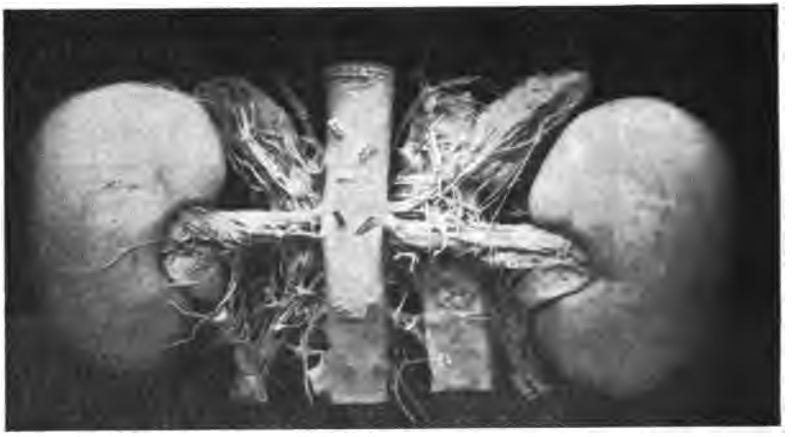
I turn now to a group of cases in which I do not at present see my way clearly. The patients, however, are so numerous, and their symptoms often so grave, as to demand our careful consideration. These unfortunates are the subjects of extreme depression, amounting at times to melancholia; they may have delusions; they are unfit for work, or even for pleasure; they are sometimes excitable, forgetful, unable to exercise due control over themselves; neurasthenia is often marked, and commonly they have no considerable local symptoms from the mobility of the kidney or kidneys. I have

asked myself frequently—Is the association of these symptoms with renal mobility a mere accidental coincidence? Can we attribute them to a common cause, or is it possible to regard renal mobility as standing in causal relation to the mental phenomena which are sometimes present? I have so frequently seen the two conditions of movable kidney and these disagreeable nervous symptoms associated that it would be foolish on my part to regard them all as accidental coincidences. A striking example of this curious combination occurred to me a few months ago. A young lady, whom I had seen some years before for some throat trouble, was sent to me by a relative who is a member of the medical profession, as she was suffering from mental excitement, difficulty in controlling herself, inability to concentrate her attention, from extreme depression at times, lassitude and exhaustion after comparatively slight exertion. She was well nourished, a fairly muscular patient with a good family history, and she had been under treatment for her nervous condition, but without improvement. General investigation, including the throat and nasal cavities, failed to show any focus of disease; but in the recumbent position, and still more easily in the vertical, the right kidney was found to descend to the upper part of the iliac fossa. I said nothing to the patient, but saw her elder sister in another room, and explained to her what I had found. Her observation in reply rather astonished me, for she said: "I expected you would find that my sister had a movable kidney"; and I began to think that I must be getting a reputation for discovering mare's nests, but on asking her why she should have expected me to discover this condition in her sister's case, she said, "Because I am myself the subject of movable kidney on the right side, which caused me extreme misery from discomfort, exhaustion, and inability to do things, for which I was treated unsuccessfully for some time, until my doctor found that the kidney was movable." She went on to say that, on the advice of her doctor, she wore an abdominal belt with a pad over the kidney, and that this had given complete relief to her symptoms, restoring her to a life of comfort and

activity. As you may imagine, under these circumstances, I strongly advised the patient who was then consulting me to resort to the same method of relief as her sister, but I am not yet in a position to say with what, if any, benefit.

When seeking an explanation of the association of renal mobility, neurasthenia, and general nervous disturbance, it is worth while to examine closely the nervous apparatus of the kidney, and its association, especially with the great sympathetic ganglia and plexuses of the abdomen. When the kidney is displaced freely downwards, few, I imagine, are prepared to deny that the circulation through the vessels, especially through the veins, may be considerably interfered with, and occasionally to such a degree as to produce hæmaturia; in some cases the calibre of the ureter is so obstructed as to produce hydro-nephrosis, which may be extreme. Some degree of albuminuria may also be found. Apart from a gross change such as hydro-nephrosis, I am struck with the frequency with which one sees fibrosis around and in the capsule of movable kidneys exposed for operation. The peri-renal fat, which should be easily peeled off the healthy organ so that it shells out of its body with the greatest facility, becomes tough and adherent to the capsule, whilst the capsule itself is often opaque, thickened, and adherent somewhat to the surface of the kidney tissue, and quite frequently the organ itself feels tough and fibrosed. Certainly, looking upon the kidney with the same critical eye that one does in the *post mortem* room, I am impressed with the frequency with which these fibrous changes in and around the capsules are seen when the kidney is exposed for mobility, especially remembering that most of the patients operated upon are only in middle life or below it. If changes such as I have mentioned are due to drag on the vessels and interference with the ureter, is it going too far to ascribe considerable importance to drag on the great sympathetic nervous apparatus as a cause, not only of the local pain and discomfort, but of the weariness and inability for work, and the more distant general nervous disturbances associated with undue renal mobility?

I show you here on the screen a photograph taken from a beautiful dissection in the Museum of the Royal College of Surgeons, showing the kidneys, their vessels, nerve supply, and some part of the great sympathetic system adjacent. The view is from the back, and exhibits also the supra-renal



THE NAMES OF THE VARIOUS STRUCTURES ARE MARKED ON THEM, AND CAN BE READ WITH A MAGNIFYING GLASS.

bodies, the aorta, and the vena cava. Taking now, for the sake of clearness, the left side, you will observe the semi-lunar ganglion lying upon the supra-renal capsule in the angle between the aorta and the renal artery. Running obliquely from above downwards and inwards is the great splanchnic nerve, communicating freely with the dorsal nerves on the one hand, and on the other with the semi-lunar ganglion. From the lower part of the ganglion, branches can be seen entwined around the renal vessels, and running to the kidney, to the lumbar ganglia and adjacent parts.

When the kidney descends, the supra-renal body usually remains behind, and with it the great ganglion, as a fairly fixed point. It seems hardly possible that the renal sympathetic and adjacent nerves can escape being dragged and pulled upon when the kidney descends under the influence of inspiratory and other muscular efforts combined with the vertical position.

The connections and distributions of the sympathetic system are notoriously difficult to describe and define, but through the splachnics the renal plexus and the semi-lunar ganglion are associated with the six lower dorsal nerves, and perhaps with all twelve; hence there is a very open tract *via* the spinal cord to the higher centres in the cerebrum; and, on the other hand, through the connections with the great solar plexus and other minor ones, the disturbances arising in the sympathetic supply to the kidney may have far-reaching influences on other organs. We are all familiar with the influence produced by emotional conditions on the functions of some of the abdominal organs; nerve stress and anxiety will often set up severe peristaltic movements of the intestines: hence the expression, "the bowels yearned." One sees the same influence producing a very rapid renal secretion under the influence of nervous fright or great sorrow. I have seen an attack of renal colic precipitated by disturbance of the emotions; so also with gall-stone colic. If emotional disturbances have such profound influence on visceral functions, is it unreasonable to suggest that the reverse may obtain, and that the drag on sympathetic nerves and ganglia by mobility of the kidney influences, either directly or reflexly, the functions of the cerebral centres? Anyone who is familiar with abdominal surgery would readily testify to the disagreeable effects of drag on the great sympathetic plexuses when patients are under the influence of anæsthetics; and those who are in the habit of giving anæsthetics, I know, are often impressed by the depression in pulse and respiration when the plexuses are disturbed. In my own view, repeated—though it may be slight—pulling on the renal plexus, and the frequent irritation of the sympathetic system thus produced, may be sufficient to account not only for the dragging pain which is experienced, but also especially in those with an easily exhausted nervous system, for the neurasthenia which is so constantly associated with excessive renal mobility. I will not, however, pursue this matter further at the present time, but will only ask you to give consideration to the points I have suggested. I may

be asked to explain the entire absence of symptoms in some patients who have one or both kidneys freely movable, and in whom the condition is quite accidentally discovered. I have no specific explanation to offer, but can only remind you of a similar variation from the ordinary type in other conditions. One patient will have stone in the kidney or in the gall-bladder dormant for years, giving no indications of its presence, while another is intolerant of such a visitor in the highest degree. One patient, with a comparatively small tumour of the brain, will have headache of such intensity as to make life unbearable; whilst another, with a tumour twice the size, will have a tithe of the pain. One patient, with a moderate degree of peritonitis, will have a rigid and intensely tender abdomen; whilst in another, with a fatal peritonitis, the abdomen is not rigid, and can be handled without inflicting pain.

What is the remedy for movable kidney? Well, in the first instance, it is useless to expect fixation of the organ merely by rest—at all events, rest to such an extent as can be practised by any ordinary person.

What is the utility of abdominal belts? This is a question to which we may get very diverse answers, but I may say frankly my own experience has not been satisfactory. Some cases get undoubted benefit, and in those in which I have seen it successful the apparatus employed has been a well-fitting abdominal belt with a pneumatic air-pad worn over the front of the lumbar region on the affected side. If the patient will learn intelligently to apply this apparatus whilst in the recumbent position before getting out of bed in the morning, pressing the kidney well into place before applying the pad, much benefit may be obtained, and this simple expedient should be adopted before the question of operation is entertained. I am bound to say, however, that this treatment may be so irksome as to make the patient speedily desire to resort to nephrorraphy.

Excluding those patients who have no symptoms, and those who find benefit from abdominal supports, we have a number of cases left for whom we have to consider whether

fixation of the kidney by operation is the best course to advise, and, further, at what time it shall be resorted to.

There will, I think, be common agreement as to the necessity of operation in those patients in whom the local symptoms are well marked, and where renal crises occur, with hydro-nephrosis, frequent micturition, and occasionally hæmaturia.

Even in cases where there is mere dragging, discomfort, lassitude, and weariness, inability to walk any distance or to make any considerable exertion, operation is, I think, not only justifiable, but is, indeed, called for. It is when we come to the patients with marked nervous symptoms, and slight or almost absent local symptoms, that divergence arises as to the propriety of resorting to operation.

Each case must be judged on its merits, but when the trouble is chiefly severe headache, and abdominal supports and general remedies have been exhausted without success, then, if the kidney is found unduly movable, I would advise the fixation of the organ as likely to give great, and, I think, permanent relief. I have mentioned two cases which I think justify me in taking up this position, and I am strengthened in my opinion by the frequency with which headache is attributable to neurasthenia when there is no question of renal mobility. Believing as I do that neurasthenia is induced in some cases by renal movement, I feel that I shall be neglecting my duty if I do not advise fixation when other remedies have failed to give relief.

When the patient's symptoms are those of marked mental depression, amounting at times to melancholia, accompanied by delusions, and we find free mobility of one or both kidneys, the decision as to what course to take with regard to fixation is not so easy. Perhaps I shall best explain this difficulty by relating my experience of operation in a few cases in which I have ventured to perform it. The first patient was a young married lady—a patient of Mr. George Elkington—who was suffering from extreme mental depression, which might fairly be called melancholia, and from delusions, with some degree of headache. She had been seen by Dr. Suckling, who

diagnosed badly displaced right kidney. Subsequently the patient was seen by others who did not agree with this diagnosis; hence my opinion was asked, and I had no difficulty in recognising free descent of the right kidney. The patient was wasting, taking her food badly, and she had unsuual pigmentation on some parts of her face. There was a bad mental history in her family, and I think there would have been no difficulty at the time when I saw her in certifying her for an asylum. It was only after much consideration that I consented to operate on this patient; such are notoriously indifferent subjects for surgical operations, and up to that time I had had no experience of the result of fixation of the kidney in melancholia and mental depression. I operated on October 30, 1902, and found that the kidney was freely movable, as was verified by my assistant and Mr. Elkington, who was present, and fixation was performed. By the time the wound was healed the patient was very much better, and in a few weeks was absolutely free from delusions, was bright and cheerful, she gained flesh, she lost her pigmentation and her headaches, and I am informed that since the operation she has had a child and has remained bright and well.

The next case is a more recent one. A male, aged thirty-five years, was sent to me by Dr. Suckling, suffering from a freely descending right kidney, associated with headache and great depression, amounting to melancholia and suicidal tendencies; the patient was losing flesh, taking food badly, and his face was markedly pigmented; these symptoms had existed for eighteen months. Nephrorraphy was performed at the General Hospital on September 9, 1904, and the kidney was found freely movable. The wound suppurated, and took longer than usual to heal; during convalescence the patient's mental symptoms remained stationary, but since he left the hospital he has rather improved.

I have operated upon three somewhat similar cases, but without amelioration to the mental symptoms. The first was a middle-aged woman, who was suffering from melancholia, delusions, and inability to discharge her daily duties,

and from headache; she had some time previously been under restraint for similar symptoms. I cannot say that she derived any benefit from the operation.

The next case was that of a young man sent to me in the first instance by Dr. Orton, of Coventry, on May 28, 1903. This patient was a spare muscular subject, suffering at that time from neurasthenia. He was unable to do any regular work; he was depressed, and suffered at times from exhaustion, especially after physical exertion. He was a very good cricketer, and would make a good performance in a hard day's cricket, but immediately afterwards was exhausted and unfit for anything for some days afterwards. His right kidney descended completely from under the costal arch. I lost sight of the patient for some time, and he came to me again, on the advice of Dr. Suckling, on June 4, 1904. At this time, in addition to his other symptoms, he complained of inability to remember or think clearly, from great depression and nervousness, and he suffered from delusions. I operated on June 29, 1904, and, though I have not seen him since he left the private hospial, I am informed that he is not benefited.

The third case was a young lady, who was the subject of delusions, mainly those of the persecution type, and from these she had suffered for some years, during the greater part of which time she was known to be the subject of freely movable right kidney. I did nephrorraphy for her on May 28, 1904, and, though an excellent convalescence followed operation, there is no distinct improvement in the mental condition. It is worthy to note in these last two cases that both of them needed after-control and general surroundings which it was very difficult to obtain for them, and this may be, I think, a possible explanation of the want of improvement. The amount of success attained in this group of cases is not encouraging, despite the apparent benefit in the first case.

I have frequently been asked whether it is not undesirable to operate upon people who are the subjects of neurasthenia. In a general way my answer is that neurasthenics are

undesirable people for operations, owing to the strain and anxiety which the prospect of operation casts upon most people, a strain which, of course, neurasthenics are less able to bear than healthy persons. Acknowledging this, however, I am bound to point out that, in my opinion, neurasthenia may be due to the drag of a movable kidney; and if such a kidney cannot be maintained in place by some form of abdominal support, then I think operation should not be denied to such patients for the fixation of the moving organ. For marked neurasthenia to be established, mobility of the kidney has probably existed a long time, and I would suggest the wisdom, when abdominal supports fail, of nephrorraphy being performed before the neurasthenic condition becomes profound. Time alone will show whether my opinion is correct, but at present my inclination is to believe that early operation will give better results than those hitherto attained.

To sum up the results of my experience, when abdominal supports fail, I would unhesitatingly advise operation in patients who suffer the worst form of local symptoms, which are known as renal crises. Just as readily would I advise operation where local symptoms of dragging, pain, frequent micturition and neurasthenia are present. Where the chief trouble is intense headache, and general remedies have had a thorough trial, I would also advise operation; but in those patients in whom there is extreme mental depression, with delusions, I am so much discouraged as to hesitate again to perform nephrorraphy. I would go further and say that I would discard the operation in these cases were it not that their mental depression, practically melancholia, is only an exaggeration; to an extreme degree it is true of the depression which a good number of patients with movable kidney suffer from.

The risk attached to operation is quite small. So far I have had no mortality, and nearly all the cases have healed by first intention; the one untoward complication which has occurred is that one patient suffered from phlebitis, although the wound healed *per primam*.

The methods of operation are legion, and it would take far too long to compare the merits of them. Some are scarcely worthy of consideration, and any one may fail to secure fixation, but there are practically half a dozen methods, either of which may be regarded as trustworthy, and neither of them as the most suitable for every case. On the whole, I prefer Goelet's method, which was described in the *Annals of Surgery*, December, 1903. He resorts to temporary silkworm gut sutures, which are removed at the end of three weeks, and which, penetrating only under the capsule of the kidney and at its middle and lower part, bring the kidney higher up than almost any other operative method, and appears to me to secure good fixation. I modify his method by decapsulating the upper half of the kidney to which sutures cannot be applied, and this secures, I believe, firmer adhesions to the upper pole of the organ than would be attainable without decapsulation. I am rather shy of leaving permanent sutures of unabsorbable material, as occasionally they return at some distance of time after the operation, and become a source of annoyance and of some distress to the patient. I will only add one other word as to the operation: it is as to the wisdom of some provision for drainage, either by means of tube or gauze packing: this is a precaution I do not like to dispense with. (Since this was written I have frequently dispensed with drainage.—G.B.)

Since my paper was written, I have read with much interest a paper in the *Practitioner* by Sir Frederick Treves. He takes a much more hopeful view than I have hitherto been able to adopt as to the utility of mechanical support for renal mobility. The failures I have seen may have been due to faulty apparatus, but I will take early opportunity of testing that which he recommends.

ON THE VALUE OF COLPOTOMY IN THE THROMBOTIC FORM OF PUERPERAL FEVER.*

By JOHN W. TAYLOR, M.Sc., F.R.C.S., Eng., *Professor of Gynæcology, Birmingham University.*

THE essential disease in the condition known as puerperal fever is an acute septic metritis. Though several forms have been described, the disease varies in degree and extent more than in character, any real difference in character belonging (for the present) rather to bacteriological science than to clinical surgery.

As others have said before me, "the placental site, after the confinement is over, is very analogous to a circular amputation wound," and its only dressing is the clean, aseptic bag of the empty uterus.

Ideal as this may be when the bag is normal and clean, nothing, perhaps, in post-operative treatment can be so foul and noisome as a recently-delivered uterus which has become septic, and it is small wonder that the inflammation under such circumstances may become intense and virulent. Particularly is this the case when some dead or dying tissue is left within the uterus, and the association of acute sepsis with retained placental remains is well known and understood: the removal of the foul contents often staying or terminating the septic infection. But in the majority of cases there is no question of this. The whole of the pregnancy is known to have come away satisfactorily; no evidence can be found of any retained product; but the womb itself has become septic, and particularly the placental site. This, and, indeed, the whole of the body of the uterus is affected and the peritoneum covering it. When the inflammatory process causes suppuration and sloughing, the consequent and accompanying peritonitis is of corresponding intensity, and

*Read at the Meeting of the Midland Medical Society, March 1, 1905.

acute suppurative peritonitis is directly induced, or, sometimes, the perforation of an abscess and secondary perforative peritonitis may be the actual cause of death. In such cases I do not know that anything can really be done for the patient with the slightest prospect of success.

The use of antistreptococcic serum or the employment of alcoholic irrigation—both theoretically of considerable promise—may afford a passing gleam of expectant hope, which relieves for a day the darkness of the impending shadow, but, so far as my experience goes, they are powerless in the very cases that are most in need of help. Many of the older gynæcologists (myself included) have tried what abdominal section and drainage could do in these cases, but when the case is recent and the conditions are as I have described, without, I believe, a single instance of success. Operative effort has not been encouraging, but all sections, whether immediate or remote, as practised in some of the less fatal cases, and *post mortem*, have alike tended to establish the fact that the spread of the disease is either direct (through the uterine wall) or through the broad ligament toward the ovaries (where not infrequently an ovarian abscess forms), or carried by means of a putrid thrombus, involving the uterine or ovarian vein, to the general circulation. Unless there be co-existing tubercular or gonorrhœal disease, the tubes are not directly involved; there is no true salpingitis; the lesions to be met with are uterine, ligamentary, ovarian, or general (through the veins).

Let me supplement what I have already said by a brief pathological description of the actual conditions met with in cases of so-called puerperal fever. "The endometrium and superficial layers of the muscular coat are found to be in a softened, infiltrated state; and in the severer types extensive superficial sloughing may frequently be observed. Ulceration also may occur, with occasional deposit of that fibrinous pseudo-membranous material which at one time suggested the relation of the process to diphtheria.

"When the disease is less advanced, these conditions may be practically confined to the placental site, where, indeed,

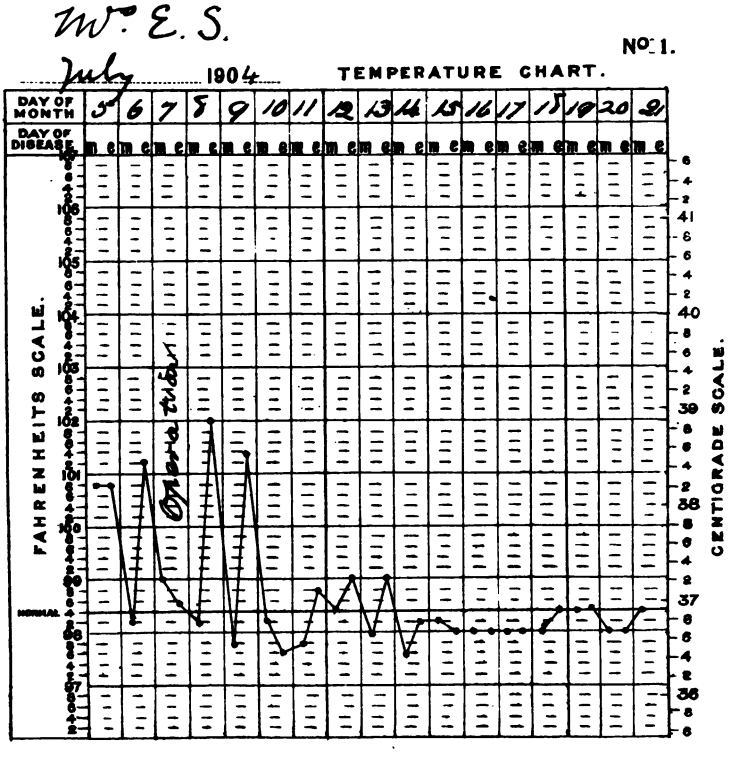
they are invariably most apparent. In cases farther advanced, the uterine tissue here, along with the thrombi pouting from the sinuses, is often absolutely necrotic and purulent." (Macharg, *British Medical Journal*, February, 1900.)

Accordingly, in the less fatal cases, in those that either survive the acuter stages, or, more often, in those where the septic infection gains hold of the wound surface at a somewhat later period (when there has already been some slight attempt at repair), it is not surprising to find that the distinguishing feature of the disease is formed by the thrombus or thrombi proceeding from the diseased uterine sinuses to the larger venous trunks. By these, the poisonous sepsis of the wound may be carried directly into the current of the general blood-stream, producing repeated rigors and all the symptoms and consequences of general pyæmia. In this, the so-called thrombotic form of puerperal fever, the larger thrombosed vessels can be readily felt on a careful vaginal examination; thrombosis of the uterine or ovarian vein being recognised by finding the hard, tender cord of the rigid vessel extending from the uterus to the pelvic wall. The swelling due to the thrombus is generally slightly increased by perivascular inflammation and swelling, and often, I believe, small abscesses may be found in close proximity to the vessel, but there is never, so far as my experience goes, any extensive swelling as in the related, but much less important, disease of pelvic cellulitis.

This form of septic metritis, which goes on to true pyæmia, serious and fatal as it is, is neither so fatal as that which is characterised by a fulminating peritonitis, nor, when fatal, is it so immediately hopeless. The patient, if of good constitution and well nursed, may live for several weeks or months, and, though many succumb to metastatic abscesses in the lungs or brain, or to the profound exhaustion caused by the pyæmic state, there are a few who, after months of suffering, during which abscess after abscess is opened and drained, may gradually get well. But in all of these cases, whether fatal or not, there is a more or less definite time when, in spite of two, more, or even several repeated rigors, the

disease is still essentially local. The clot in the vein, though a carrier of infection, has not yet broken down and been taken piecemeal into the circulation, and if only the base and surroundings of the clot can be got at and made clean, there is still a chance of aborting the disease.

The best way of doing this (for I believe it can often be done) is to open up the vaginal roof on the side chiefly affected, and in a good light to search for small abscesses or pockets of pus in the uterine wall and in the broad ligament; to empty these, stuffing the little cavities with moist iodoform gauze (Linton); and finally, unless it has been already done in the course of the operation, to open the pouch of Douglas, examine the parts from within the peritoneum, specially feeling for any abscess of the ovary, freely opening it, if present, or removing the ovary affected, and, if there is no further work to be done, leaving a thick piece of iodoform gauze behind the broad ligament, and more or less surrounding the inflamed vessel.



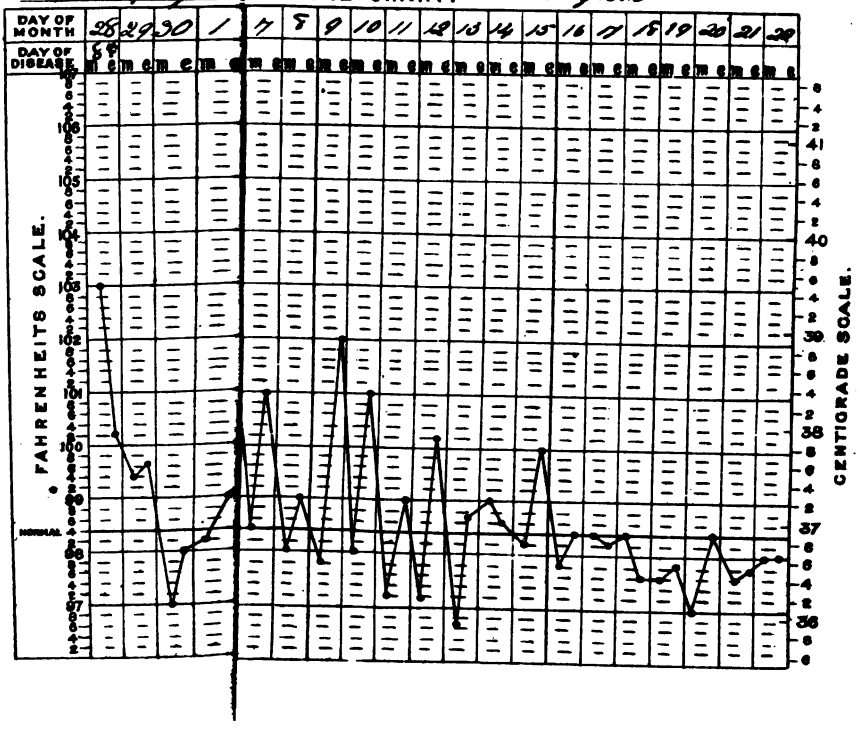
hensive of danger. I felt a hard, tender swelling at the right side, which I thought might be a small abscess, the more so as Dr. Brice said there had already been some discharge of pus from the vagina, with temporary relief of symptoms. The patient, however, made no improvement. She was a poor woman, without any facilities for comfort and nursing, and on July 5 I admitted her to hospital. On admission her temperature was 101° and her pulse 148. On the morning of the 7th I operated as I have already described, opening the pouch of Douglas, and finding, as I then expected, that the firm swelling I felt was caused by thrombosis of the right ovarian vein. I am not conscious that in this operation I directly opened any pus collection, but I packed the part behind the thrombus with iodoform gauze, which I left as a pelvic drain. The improvement was immediate. There was no return of the rigors, and in a fortnight the patient was convalescent. No proper records were taken of the temperature before admission. The accompanying chart shows the temperature from admission until her discharge to the convalescent home.

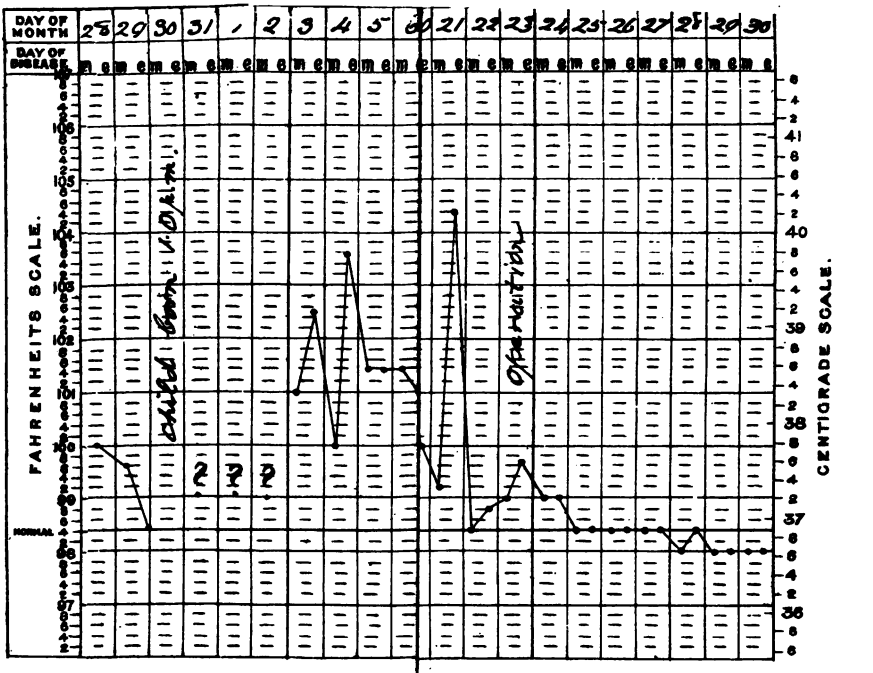
The second case is more typical, and occurred after a full-term pregnancy. Mrs. M.P., aged forty-one years, having eleven children, was confined on June 20, 1904, and for a few days appeared to be doing well. Her temperature, however, began to rise, and on the eighth day it was 103°F. On this date a nurse was obtained who could keep a record of the temperature, and the accompanying chart shows its main variations after this date. I saw her on the 6th July, and found a recent laceration of the cervix, but no indication of any retained product, and no sign of any extra-uterine swelling or tumour. The patient complained of occasional chilliness, but there had been no definite rigor, and no pain. The temperature appeared to be falling; the patient was perspiring freely, and I gave a guarded but favourable prognosis. I heard nothing more of her for nearly two weeks, when another doctor—the third in attendance on the case, I think—happily advised that I should see the patient again, as he thought there must be some decomposing placenta within the uterus. I found the patient very much weakened and

W. M. P.

No 2.

June July. TEMPERATURE CHART. August





emaciated by the recurrent pyrexia and profuse perspiration which had marked the period since I had last seen her. She was evidently rapidly losing ground, and her condition (with a temperature of 105.3-5°) was not only serious, but alarming. On examination I readily felt the thrombosed vessel of the right uterine, extending outwards to the pelvic wall, and above this the ovarian vein appeared to be affected also. Except for these cord-like swellings, the broad ligament or inter-pelvic space was healthy. The uterus was well contracted, and there was no vaginal discharge, hæmorrhagic or otherwise. Dangerous as it seemed to do so, I suggested we might move the patient and make an effort to stop the progress of the disease by operation—not by curetting or intra-uterine treatment only, which in my opinion would be futile and was uncalled for, but by cutting down on the thrombus and its immediate neighbourhood, and exploring for pus. I admitted the patient to Sparkhill, and on July 21 operated as I have described. I almost immediately found an abscess in the substance of the cervix. This I opened freely, liberating one or two teaspoonfuls of light yellow pus, which was not offensive. On dissecting up the broad ligament of the right side and the posterior fornix, I came upon a second abscess in the uterine wall, close to the uterine end of the thrombus. Both cavities were well cleaned out and packed with iodoform gauze. Failing to find any further collection from the vaginal incision, I opened the peritoneum and explored the pelvis, passing a large cushion-drain of iodoform gauze behind the uterus and the right broad ligament. The patient, as you see, did not immediately get well but began directly to improve, and within a week or so was out of danger. She is now perfectly well and active, without any visible wound, and without having suffered the loss, or even impairment, of any organ or function.

The third case which I bring before your notice was a complicated one of pregnancy, parturition, myoma, and sepsis, which gave Dr. Walter Garman, of Wednesbury, and myself great anxiety and trouble. Mrs. E. C. J., aged thirty-eight years, was attended by Dr. Garman in her fourth confinement

on August 30, 1904. For some days before the confinement she had not been well, her temperature on the evening of the 28th being 100°F., and her urine containing some albumen. The child, as I have said, was born on the 30th, and, at first, there appeared to be little or no cause for anxiety. On the fourth day, however, the temperature went up to 102°, and on examination Dr. Garman found some kind of tumour within the uterus, part of which was detached and broken by the examining finger. The next day, in spite of an intra-uterine douche, the temperature rose to 103.3-5°, and on the sixth day (September 5) I saw the patient, with Dr. Garman. I found a small sessile tumour, with a base as large as a florin, growing from and adherent to the inner wall of the uterus at the margin of the placental site. This was still rough, and easily to be distinguished from the rest of the endometrium. The tumour felt remarkably like an accessory or succenturiate placenta which had become isolated, but on removing it (on the morning of September 7) it was found to be a fibroid. This was removed entire by enucleation with the finger, the base and parts surrounding well cleaned with biniodide solution, and the uterus packed with iodoform gauze. The patient had a severe rigor after the small operation was over, but for three days steadily improved, the temperature coming down to 99°. On the 10th, Dr. Garman removed the gauze, and almost immediately the temperature began to rise again. The next day it was 102°, the next 103°, and the next 104°. This was followed by a drop, another rigor, and again a slowly-mounting rise, which reached 104° again on the 17th, and nearly 105° on the 18th. The pulse at this date was 140, both morning and evening. I saw the patient again, with Dr. Garman, and found indications of a thrombus on the right side. I advised operative treatment, and the patient was brought into Birmingham on the 20th. On this day her condition had rather improved, and the temperature fell to 100°. On the 21st she had another severe rigor, and the temperature rose again to 104.2°. On the 23rd I operated, opening up the tissues behind and to the right of the uterus and in the right broad

ligament. On nearing the uterine end of the thrombus, I came upon a small abscess, with very dirty and fœtid contents, which was surrounding the thrombus between the layers of the broad ligament. This appeared to be the chief source of mischief and inspection. It was well cleaned, the cavity packed with iodoform gauze, and the patient put back to bed. She made an uninterrupted recovery, as you see. Within a week she was eating and sleeping well, with a normal temperature and pulse, and was back at home again within three weeks of the interference.

In bringing these cases before you, although my work is experimental and somewhat tentative, I think you will agree that it is sufficiently encouraging to justify the notice I have given it, and to warrant further effort in surgical treatment. The ideal operation in these cases of thrombosis would be to tie the veins and turn out the blood-clot, as well as to explore all surrounding parts; but I find it is hardly possible to do all this from the vaginal incision, and the patient is rarely in a fit condition to stand the combined operation of abdominal as well as vaginal section. Ligature of the veins for the treatment of puerperal pyæmia has been already done in Germany, but with indifferent success. Trendelenburg is reported to have tied the hypogastric and spermatic or ovarian veins in one case with success; but in a report of ten cases collected by Opitz, in which this treatment appears to have been carried out, either with or without accompanying hysterectomy, there was only one recovery out of the ten cases operated upon (*Deutsch. Med. Wochensch.*, 1904, Report in *Journ. of Obst. and Gyn. of B.E.*).

As a matter of fact, too, in the earlier stages of the disease it is not so much the clot itself as the tissues surrounding the uterine end of the thrombus which contain the focus or foci of suppuration, and the opening up and treatment of these is evidently of greater importance than the turning out of the thrombus. The clot itself, so long as it remains solid and firm, may even be regarded, I think, as a kind of conservative lesion, the interference demanded being essentially peri-vascular and uterine or ligamentary.

Before concluding my paper, it may be well to insist on the importance of the right kind of interference in these cases. My own experience is that repeated rigors and consequent pyrexia met with after confinement usually suggest the probability of something having been left behind within the uterus, and even without the slightest ground for this belief other than the presence of these symptoms—the services of the surgeon and consultant may be demanded for the express purpose of searching for the supposed cause of trouble within the uterus. Under such circumstances, those who are already in attendance may—very naturally—be grievously disappointed if their recommendation be not followed; and some years ago I have been over-persuaded (against my better judgment) to curette the uterus when I had little or no expectation of finding anything within it. Obviously, when circumscribed abscesses are present either in the substance of the uterine wall or in the broad ligament, any meddlesome intra-uterine interference is not only futile, but as all the parts are intensely congested, curetting generally causes violent hæmorrhage, and the patient is made much worse instead of better by it.

In all of these cases, intra-uterine exploration and treatment should be very gentle and digital only, until some abnormal or foreign body is proved to be within it, and the pelvis on each side of the uterus should always be carefully examined bi-manually for evidence of thrombus.

Again, it is very natural to think that abdominal section may afford the best chance of dealing with the intra-pelvic mischief found in this form of puerperal fever, especially when swellings of rather uncertain nature can be felt on a bi-manual examination of the pelvis. Some twenty years ago I tried what I could do in this way, and, though in two cases I had the short-lived satisfaction of removing a decided abscess of the ovary, the operation made no appreciable difference to the progress of the disease. I have not tried it again, but if the ovarian vein be chiefly or alone affected, I can conceive (as I have already suggested) that its ligature would be the surest way of localising the inflammation. It would still,

however, I believe, be just as necessary to open up the side of the uterus and broad ligament in order to get at the centres of suppuration, and this can be done much better from below. Here in this limited tract of tissue, between the endometrium on the one hand and the pelvic brim on the other, in uterine wall and in the broad ligament around the large vessels, the main fight is going on for some week or a fortnight before the greater issues are decided; and if the surgeon wishes to help in the fight, here, where the battle is most active, is the place, I believe, for his wisest interference.

THE RICHARD MIDDLEMORE POST-GRADUATE LECTURE, 1904.

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THIS annual course of lectures was instituted by the founder—Richard Middlemore—to encourage those engaged in the special practice of ophthalmology to digest and arrange, for the service of those members of our profession who are engaged in the absorbing duties of general practice, the results of recent special research and experience.

In pursuance of this object, so clearly laid down by the benevolent and enlightened founder of these lectures in his trust deed, I propose to-day to review briefly recent advances in ophthalmic therapeutics, leaving aside all those which are known to be incomplete, or which have been too recently introduced to have given sufficiently convincing proofs of their value. I shall include not only new materials and methods, but also old remedies which are being used in new and more effective ways.

Until recently it was considered that the whole really valuable repertoire of the ophthalmologist consisted in a few drugs, of which mercury, iodide of potassium, opium, belladonna, nitrate of silver, alum, zinc, and lead were pretty much the sum.

Now we have not only these, but many new general constitutional remedies, and a whole host of local anæsthetics and antiseptics, and the resources of opotherapy are called to our aid.

As it is not my intention to deal with ophthalmic therapeutics in their full extent, as I did in a course of lectures some time ago, I shall not take the questions of diathetic and general bodily treatment in connection with eye disease into consideration. I shall confine myself to a review of the

more valuable among new materials and new methods which are now being employed. For so rapid and numerous are the advances and new departures presented to us nowadays that if I were only briefly to mention all of them in connection with ophthalmology I should weary and confuse you. I shall therefore touch only those novelties whose worth has been established, and which are standing successfully the test of trial. And I will place as the preamble and keynote of my digest the statement that the general trend of modern ophthalmic therapeusis lies in the endeavour to bring the remedy as far as possible into direct and immediate relation with the disease.

Recent advances in ophthalmic therapeutics may be considered under two heads—(1) new materials; (2) new methods.

I propose to deal first of all with new materials. The new materials may be ranged under the following divisions:

1. Local anæsthetics (*a*) of superficial, (*b*) of deep potency.

2. Materials acting especially upon the iris and ciliary muscle.

3. Materials affecting the vascular conditions of the eye.

4. Astringents and antiseptics, and other general remedies in their special applications.

First, then, of local anæsthetics. It is difficult for anyone whose acquaintance with the treatment of eye disease is recent to imagine the conditions which existed before the introduction of cocaine. Belladonna and its alkaloid atropine and opium were the only materials available as local anæsthetics, and they were very tardy, uncertain, and incomplete in their effects. It is not too much to say that the introduction of cocaine revolutionised the treatment of the superficial diseases of the eye; and in operative work made easy that which had been beforetime impossible without the help of general anæsthesia. I allude to such operations as cauterisation and curetting of corneal ulcers, removal of conjunctival cysts and pterygia, tenotomies for strabismus, advancements of the ocular muscles, and other lesser procedures, which are now done as matters of ordinary routine.

We are all so familiar with the anæsthetic power of cocaine that I need say but little about it. I shall content myself with emphasising the fact that it is not to be used in all cases with safety. Its mydriatic action has been the means of precipitating acute attacks of glaucoma; and its toxic effect is apt to show itself when solutions of more than moderate (that is, 4 or 5 per cent.) strength are used, and especially if the solution be injected sub-conjunctivally; and it has also the effect, if used for a long period, of reducing the nutrition and resisting power of the cornea. In order to escape these risks many substitutes for cocaine have been brought forward by the chemists. The chief of these—the only ones, in fact—which have attained to even moderate trial are eucaine, tropococaine, and holocaine.

Eucaine is less toxic than cocaine, but it is very irritating and painful when applied to the conjunctiva, and its anæsthetic effect in no way excels that of cocaine.

Tropococaine is also very painful, even when applied in very weak solutions; but the anæsthesia produced is very complete and lasting.

Holocaine is a powerful local anæsthetic; but it is much more toxic than cocaine, and therefore cannot be recommended as its substitute.

On the whole, therefore, there is little to be said in favour of these three most efficient of the substitutes for cocaine.

From recent testimony, however, it appears that the ideal local anæsthetic is at last within our reach. A substance called stovaïne has been discovered by the French chemist, Furneau; it is a hydrochloride of amyline Betâ, and in its chemical reactions it is identical with cocaine. Its solution can be boiled, and so rendered aseptic, without becoming decomposed—a proceeding impossible with cocaine. It produces an anæsthesia as complete as that produced by holocaine, and, as it is absolutely free from poisonous qualities, it may be injected freely beneath the conjunctiva or into the eyelids. A 4 per cent. solution in distilled water is used, and when injected beneath the conjunctiva produces an anæsthesia lasting fully fifteen minutes, allowing of the performance of an operation for strabismus, and little or no pain

is felt. It is, perhaps, not quite so satisfactory for instillation into the conjunctival sac as cocaine, because it produces a good deal of smarting before its anæsthetic effect is reached. For all purposes, perhaps the best local anæsthetic now at our command is to be obtained by combining a small quantity of cocaine, say 1 per cent., with 4 per cent. of stovaïne. This combination is extremely effective both in degree and duration of anæsthesia, and possesses a minimum of toxicity.

I come now to local anæsthetics producing profound effects, and relieving deep-seated pains.

A drug called dionine, which has recently been introduced into medicine as a sedative and hypnotic, has also earned a definite position as a local analgesic in eye diseases. It is a derivative of morphia, being the hydrochloride of ethylmorphine. As compared with cocaine and the class of superficial anæsthetics of which I have just spoken, its influence is more penetrating. Thus, whilst the drugs of the cocaine class relieve pains of superficial character in the conjunctiva and cornea, without affecting the deeper-seated pains of episcleritis, iritis, irido-cyclitis, and glaucoma, dionine is found to exert upon these latter a decided and lasting calmative influence. And it is curious that, though the profound effect of dionine is abundantly proved, its superficial effect is very slight; it only feebly benumbs the cornea and conjunctiva. It is most effective combined with cocaine or stovaïne and atropine for use in cases where a mydriatic as well as an analgesic is needed, such as iritis and irido-choriditis; whilst where a myotic is needed, as in glaucoma, dionine should be combined with eserine or pilocarpine. Dionine may be used alone in solutions of from 2 to 5 per cent., and the solution should be freshly made. If a solution should cause much lachrymation and irritation, an ointment of the same strength and composition should be used, with vaseline as the vehicle.

In corneal ulcers and in keratitis with deep-seated pain, I have found a 2 per cent. solution of dionine, with an equal strength of cocaine and $\frac{1}{2}$ per cent. of atropine, very useful.

In iritis and irido-cyclitis, a 4 per cent. solution of dionine, with 1 per cent. of atropine, with perhaps 2 per cent. of cocaine, is most admirable in its effects.

In all cases of glaucoma, dionine in 2 to 4 per cent. solution should be added to the myotic used, and persevered with until iridectomy can be performed.

Besides its analgesic action, dionine increases the mydriatic effect of atropine, and it also acts as a lymphagogue, and by encouraging nutritive changes it hastens the absorption of exudations into the anterior chamber, and helps to clear away the masses of broken up lens matter left after cataract extraction, and after wounds of the lens; and not the least of its valuable lymphagogue actions is that of diminishing tension in glaucoma.

One important fact must, however, be borne in mind when ordering dionine, to which I have before briefly alluded, and this is that it sometimes causes very considerable irritation when its solution is instilled into the eye, producing swelling, and even great chemosis of the conjunctiva; but no harm ever follows; and, as the eye becomes accustomed to the drug, the tendency to become irritated subsides and does not recur. Still, as this effect is sometimes very alarming to the patient, it is well to begin with a weak solution of, say, 2 per cent., and to add cocaine of the same strength; and, when the stage of toleration is reached, the strength of the dionine may be increased to 5 or even 10 per cent.

Another local anæsthetic called *acoine* has been very warmly recommended by a prominent French ophthalmologist, Dr. Darier, who may be regarded now as the leader of our speciality in the modern advances in therapeutics. This substance will render the cornea and conjunctiva insensible, and the insensibility will last a long time; but it has for this purpose to be employed in very strong solutions, and it produces great irritation and even pain before the anæsthesia is reached. Its value, therefore, is not as a superficial anæsthetic. But it has a use peculiarly its own. It has the quality of reducing the pain of sub-conjunctival injections, of which I shall speak more fully shortly. By some ophthalmologists, a combination of acoine with cocaine and sodium

chloride has been used sub-conjunctivally in operations for strabismus, and in hypodermic injections before operations for ptosis, and for operations about the lachrymal apparatus, it is said, with excellent effect.

I go on now to speak of agents which modify the action of the iris and the ciliary muscle, such as atropine, scopolamine, etc.

It is not necessary to say much about *atropine*: it is familiar to all of us, and nothing new has been discovered concerning it. I will only repeat the caution which can never be out of place, namely, that before using it the state of the tension of the eyeball should always be ascertained. Many an eye bordering upon or in the early stage of glaucoma has been lost by the rash use of atropine.

Scopolamine, though not very new, is but little used in ordinary practice. It acts more energetically than atropine, and may be used where atropine cannot be tolerated on account of the irritation produced, or, where the eye has become dulled to the effect of atropine, owing to its prolonged use. It must be always remembered, however, that scopolamine is a much more powerful and toxic agent than atropine, and should be used in solutions of about one-fourth the strength of atropine; a solution of one grain to the ounce of water, with ten grains of cocaine, will produce the most rapid and powerful mydriatic action that can be desired.

Duboisine I would advise you not to use: it is very toxic, and possesses no advantages.

All these mydriatics have at least a two-fold effect. They dilate the pupil, and at the same time paralyse the ciliary muscle. The latter is oftentimes an effect not desired, while the dilated pupil is needed.

Fortunately, a material has been discovered which, while producing a maximum dilatation of the pupil, produces only a very slight and transient effect upon the ciliary muscle. It is a synthetic compound with a terribly long chemical name, conventionally known as *euphthalmine*. A 2 per cent. solution produces in half an hour medium dilatation of the pupil, and a 5 per cent. solution the widest dilatation possible.

There is practically no effect on the ciliary muscle, so accommodation of the eye for near vision remains unaltered. For all ophthalmoscopic examinations, and in judging of the position and extent of synechiæ, etc., in fact, in all cases where temporary dilatation of the pupil is necessary, this agent—euphthalmine—leaves nothing to be desired—especially as it is un-irritating and non-toxic.

As to myotics, I shall dismiss them in a very few words. Nothing has been found to excel in certainty of action eserine and pilocarpine; and they appear to fill adequately the rôle demanded of myotics.

I come now to a material which has of late attracted immense attention as a modifier of vascular conditions. I mean the supra-renal extract and its active principle, *adrenaline*. The supra-renal capsules supply an internal secretion which seems to have the power of exciting muscular contractility and affecting especially the heart muscle and the muscular walls of the blood-vessels. The extract acts as a vaso-constrictor, and causes a temporary increase of blood pressure by acting at the periphery upon the smooth fibres and nerve endings. This effect appears to be due to the adrenaline, as the active principle is called by Takamin, of New York, its discoverer. Its exact chemical constitution is not known; but it possesses remarkable and, apparently, constant qualities as an astringent and hæmostatic. It is, as you know, being greatly used in other branches of medical practice, and in the treatment of eye diseases it has a distinct and definite value. It is but right to say, however, that its usefulness and value have been unduly exaggerated. When it first appeared, all sorts of wonderful, almost magical, effects were claimed for it; but clinical observation is gradually assigning to it its proper sphere, within which it is a trustworthy agent. It is of use as a diagnostic and as a remedy. It is useful as a means of discrimination in inflammations of the eye; for example, when an eye is greatly inflamed, it may be necessary to differentiate between superficial and deep hyperæmia. If the hyperæmia be superficial, that is, conjunctival, only, the instillation of a drop of the

standard solution (1-1000) will in a very short time so contract the vessels of the conjunctiva that the membrane will become practically bloodless; and if the sclera show white and clear beneath it, it will be made manifest that conjunctival trouble only has to be dealt with. But if, in addition to the conjunctival hyperæmia, there should be a ciliary zone of redness, which marks the deep scleral injection of iritis or irido-cyclitis, we shall see the superficial (conjunctival) redness disappear, and the deep redness remain for some long time. perhaps altogether unaltered. In diagnosis, this action may be most valuable.

As a remedy, adrenaline is valuable in conjunctivitis, phlyctenular keratitis, and superficial corneal ulcers and wounds. It may be used alone, or with cocaine, or with cocaine and atropine, and, if necessary, the sulphate or chloride of zine, or an organic salt of silver, or the perchloride or cyanide of mercury may be added to it. In deeper troubles, such as episcleritis and iritis, it assists the action of cocaine and atropine by its vaso-constrictor power, and it also seems to have some influence in assuaging ciliary pain. In increased tension, when used with eserine or pilocarpine, it helps their action in marked degree, for it has been shown by conclusive experiment that it reduces intraocular pressure. Lastly, in operations about the eyelids and conjunctiva, and in tenotomy for strabismus, it is of great temporary value as a hæmostatic. But, where its vaso-constrictor power is sought, it must aways be borne in mind that reaction after its use is very marked, and so the temporary anæmia is often followed by increased vascularity, or by hæmorrhage from the relaxed, divided vessels.

From an extended and careful personal observation of the uses of adrenaline, I would say that its most trustworthy influence is exerted as a help in diagnosis, and in superficial operations on the eyeball and eyelids. In treatment of disease, it is a useful adjunct in inflammations of the anterior portion of the globe; but it is not a remedy to be trusted to alone.

Among the other new materials in our possession, the new organic salts of silver claim an important place. They are increasing rapidly in number. Hardly a month passes but some new organic compound is presented to us by the industrious chemist, and each is—by its advocate, at least—credited with almost magic power. Silver has been combined with lactic acid, casein, protein, nuclein, vitellin, gelatose, and many compound organic acids.

Of many of these substances which I have tried, those of which I have proved the value to my own satisfaction are in order of excellence : Argyrol, protargol, and argentamine. These and many of the others have the one—and I had almost said *only*—advantage over the nitrate of silver of being less caustic and less painful.

Of the inestimable value of silver nitrate in the treatment of purulent affections of the conjunctiva, it is impossible to speak too emphatically. It has been an absolute boon to humanity. But it has always had the serious drawback of being, even in very weak solutions, extremely painful.

This, perhaps, is the place to say a few words on the new views held as to the causation of conjunctivitis. Twenty years ago, or possibly much less, we used to speak of acute purulent, catarrhal, granular, and chronic conjunctivitis ; and infection from specific discharges, cold and local irritants included the bulk of causes. Now we know that most, if not all, varieties of conjunctivitis are due to the presence of micro-organisms.

Neisser, first of all, found the gonococcus in purulent ophthalmia ; now in other forms of conjunctivitis, the streptococcus, the pneumococcus, the colon bacillus, Week's bacillus, Lœffer's bacillus, and last of all a diplo-bacillus have been found. And in granular conjunctivitis or trachoma, and in phlyctenular forms, we have little doubt of bacillary origin, though the actual bacillus has not yet been found. From this we can easily see how differently conjunctivitis must now be described, and how widely some of the forms differ from the old classification ; and from the same evidence we may draw the comforting assurance that treatment of all

forms must have this common aim, namely, the destruction of the micro-organism which is the cause.

Of all remedies which have ever been used, silver has proved most efficacious, and the organic salts which now offer it under the most favourable combinations are the most manageable. The organic salt which I believe to be next to the nitrate the most potent and trustworthy is what is known as argyrol, the vitellin compound. It may be freely used without any pain following its application, and it is suitable for all cases in which the nitrate may be used. It may also be used in cases of corneal ulcers and wounds where suppurative changes exist or are threatening, cases in which we would like to use the nitrate, but in which it is inadmissible on account of its intensely irritating action. A solution of from 5 to 25 per cent. of argyrol in water may be applied in blepharo-conjunctivitis, dacryo-cystitis, catarrhal ophthalmia, and even in ophthalmia neonatorum and gonorrhœal ophthalmia. In the latter cases a 25 per cent. solution, patiently and thoroughly applied, by carefully brushing it into the conjunctival surface, has answered perfectly, and has been practically painless. In short, in all forms of conjunctivitis where purulent or muco-purulent discharges are present, this compound, argyrol, may be trusted.

Protargol, the protein combination, is another most useful compound, but its application, especially in strong solutions, is painful, though far less painful than the nitrate of silver.

Argentamine, a compound of silver nitrate in ethylenediamine, I have found useful; but the solution does not keep, and its application is painful.

The other organic silver compounds possess no advantages over those mentioned, though, as is usual with all new remedies, they excel all others when used by their inventor or introducer.

It is claimed for these new salts of silver that they do not stain the conjunctiva as the nitrate does. This, I find, is an error. The staining is much less, and does not come on so quickly; but where it is necessary to use the silver for a long

time, it must be watched for, and prevented as far as possible by washing the conjunctiva with warm water after the application of the silver solution.

Powders for insufflation into the eye are coming again into more frequent use. In early times they were much used for the removal of corneal opacities. This plan fell into disuse. But now the value of dry applications in wounds of the conjunctiva, cornea, and sclera is well established. They are also beneficial in trachoma, follicular conjunctivitis, and all forms of conjunctivitis which threaten to become chronic, and in corneal ulcers. The powders used are protargol in trachoma, and iodoform and xeroform and calomel and boric acid in the other cases. They must be rubbed down until they are as finely divided as possible, and then blown into the eye from a tube, or shaken in from a large dry camel-hair brush. After the ocular surface has been well powdered, the eyelid should be moved over the eye by a gentle massage movement, so as to cause the powder to enter thoroughly into contact with the conjunctiva and cornea.

Ointments and oily solutions of the various agents used for superficial application are becoming more and more used. They have the advantage of keeping better than watery solutions, and may be given to patients to use at home with less risk of being swallowed by mistake. They are in certain instances better borne if needed for long periods, and in some cases, as for example, in oily solutions of eserine, the effect is stated to be greater and more lasting. As a rule, the pure alkaloid dissolves best in oil, better than the salts, and castor or almond oil or vaseline make the best vehicles. They may be used in the same strength as watery solutions.

So far of new materials. I come now to the consideration of new methods of application of remedies, old and new. The most striking methods are the local applications by means of injections of solutions of various substances: (1) beneath the conjunctiva; (2) into the eyeball itself; and (3) into the general circulation.

1. *Sub-conjunctival Injections.*—This method, which is the result of gradually accumulating experiment and trustworthy evidence, is founded on the belief that where the lesion can be shown to be due to bacterial infection or to the action of a pathological virus, injection of the remedial agent into the very heart of the lesion and of the infected tissues puts an end to the germ or the virus, and arrests the effects to which they give rise. And it is further believed that the same method may produce a sclerosis and cicatrisation of the lesions already developed.

It must, I think, be apparent that when remedies are applied directly to the part diseased, effects are more likely to be rapidly produced than when they are taken into the stomach or applied through the skin; and, as time goes on and trial proves the best form of remedy to be used, and the best conditions under which, both as to locality and vehicle, injections may be made, we shall see the direct application of remedies superseding, where possible, the mediate methods of administration.

I would only draw attention for a moment, as an illustration from general medicine, to the practice now in vogue of intra-pulmonary injections of solutions of aristol, guaiacol, and creosote in tuberculosis, as showing the general trend working towards the direct application of remedies.

Dr. Darier puts the aims and warrant for local and direct therapeusis very forcibly as follows :—"Whenever a primary or secondary affection is localised in an organ so important as the eye, it becomes of the greatest consequence to prevent or extinguish the affection locally, if possible, without losing sight of general indications." And he advises injection of the agent into the infectious focus itself, or into its immediate neighbourhood, in such a way as to irrigate and asepticise the whole of the lymphatic territory in which the morbid process has lodged itself.

The solutions most frequently employed in sub-conjunctival injections are those of sodium chloride and of the most soluble salts of mercury, the cyanide, the perchloride, and the bin-iodide. Other solutions proposed, the value and fitness of which have yet to be accurately assessed, are the

cinnamate of sodium, the iodate and iodide of sodium, iodide of potassium, salicylate of sodium, and others which it is not necessary to mention.

The method of procedure in sub-conjunctival injection is sufficiently simple. The conjunctiva is rendered insensible by stovaïne and cocaine, and a hypodermic syringe, which has been carefully sterilised, is charged with the quantity of fluid to be injected. The eyelids are then well opened by means of a speculum, or the fingers of an assistant, and the point of the syringe is passed well beneath the conjunctiva, a fold of which has been picked up with a pair of forceps. The situation best adapted for the injection is reached by making the patient look downwards and inwards. The needle should then be entered as far back over the upper and outer part of the globe as possible, and the fluid slowly injected. It is never well to inject the fluid too near to the cornea, because undesirable disturbances of its nutrition have followed injections made too near to its margin. The quantity of fluid used must necessarily vary with its strength and with the gravity of the case. From two to fifteen minims may be injected at once. But if a large quantity be considered desirable in order to produce a rapid effect, it is wise to pass the needle rather deeply towards the back of the eyeball, so that the fluid shall pass into the retro-bulbar region.

Sub-conjunctival injections are often extremely painful, especially when large quantities of strong solutions are used. Here a solution of 1 or 2 per cent. of the substance called acoine—of which I have just spoken—when added to that of the agent employed, greatly reduces the pain. I have not found it prevent pain, as is stated by some authorities, but it certainly seems to reduce the severity and the duration of it.

The solutions employed must be of very soluble salts, or the desired absorption will not take place. Precipitation of the salt in the sub-conjunctival tissues would defeat expectation. The solution must also be thoroughly sterile.

The purposes of sub-conjunctival injections have been well summarised by Darier, as follow :—

1. They are the promptest and most powerful means of producing antisepsis in traumatic or operative infections, and in infectious ulcers of the cornea associated with hypopyon.

2. They have a powerful resolutive action upon torpid parenchymatous keratitis, upon choroidal exudations, and in cases of plastic iritis when the venous stasis is not too marked.

3. As an anti-syphilitic, they have a rapid and intense action upon specific ocular manifestations in all stages.

4. Injections of sodium chloride have a powerful action upon the intra-ocular nutritive changes, quickening the absorption, especially of corneal infiltrations and sub-retinal exudations.

I will now go over briefly the various forms of eye disease in which sub-conjunctival injections are most useful, and I will also give the appropriate composition of the various solutions to be used.

1. It is in corneal affections that they became first useful, as it is easy to deal with the conjunctiva directly. In deep-seated or deeply-penetrating infective ulcers and abscesses of the cornea, where the invasion is too profound for the actual cautery to reach without doing more damage than good, injections are our most trustworthy means of succour. The most useful form in which to administer them is the following :—Cyanide of mercury, from 1 in 1000 to 1 in 5000 ; sodium chloride, 1 in 1000 ; and acoine, 1 in 100. From 5 to 15 minims of the solution may be injected. The strength of the solution and the quantity injected must be proportionate to the severity of the case, and it may be repeated every day or every other day.

2. In iritis of syphilitic origin, injections of 1—3000 of the cyanide of mercury greatly aid the general treatment, especially after the most acute stage has passed. And in chronic iritis with adhesions, serous iritis, irido-cyclitis, irido-choroiditis, and choroiditis, especially of specific origin, the general treatment is greatly aided by the injection of the mercurial salt above mentioned, that is, the cyanide in solution of from 1 in 1000 to 1 in 5000. In the conditions of increased tension and fulness of eyeball which occur in course

of the last-mentioned diseases, the effect of sub-conjunctival injections is increased by paracentesis of the cornea. The evacuation of the aqueous humour and the consequent temporary relief of tension allows of and encourages absorption of the injected fluid.

3. In sympathetic ophthalmitis there appears to be sufficient evidence of help gained by the sub-conjunctival injection of mercurial solutions. In this terrible disease the only remedy which has ever even appeared to do good, so far as my experience goes, is mercury, and in my opinion it should be tried in every fashion.

4. Saline fluids have been used sub-conjunctivally in the less acute forms of glaucoma proper; but, so far as evidence goes at present, they cannot be relied upon. The treatment of glaucoma which is to supersede iridectomy has yet to be discovered.

But there are forms of glaucoma, such as that which is complicated with hæmorrhage in the retina, where iridectomy is inadvisable, and sclerotomy (as usual) of no avail. In these cases injections may be tried.

It is reported that solutions of iodate of sodium sub-conjunctivally injected have produced remarkable effects. Their use has not yet been systematised, but improvement in glaucomatous conditions has been noted; the hazy media have cleared, tension has been reduced, and improvement of vision has followed. It is right, I think, even with only the slight evidence before us, to try this plan of treatment in what have been hitherto hopeless cases.

Perhaps I may here interpolate a few remarks on some new light which is being thrown on that perennially interesting subject, the etiology of glaucoma. It is too soon, perhaps, to say anything definite; but it is becoming more and more certain that the retention theory, as it is called, that of the chief cause of glaucoma being the interference with the outflow of fluids from the globe by inflammatory blocking of the filtration angle, so warmly held by Knies and the mechanical theorists, is more than doubtful. It appears now as if we were on the threshold of a more comprehensive

and vital explanation of the phenomena of glaucoma, properly so called. For I need hardly say that all increased tension is not glaucoma in the precise sense.

Without going deeply into the matter, which would be outside of our purview of to-day, I would only ask that if true glaucoma should turn out to be due to pathological changes in the choroid and its lymphatic and vascular elements, of which there appears to be good evidence, is it too much to hope that cure (not merely alleviation) may be effected by measures which shall deal locally and generally with the structural impairment underlying these changes?

Perhaps the explanation offered of the *modus operandi* of sub-conjunctival mercurial injections in choroiditis may be justly linked with the foregoing observations. The reason given for the especial efficacy of these injections in choroiditis is the fact that their local effect in the choroid is assured by the easy route of communication existing between the choroidal and sub-conjunctival lymph-spaces through the medium of the peri-vascular sheaths of the venæ vorticosæ. The fluids injected sub-conjunctivally may therefore enter the eyeball not merely by osmosis, but also by directly communicating channels.

In lenticular opacities, solutions of iodide of potassium and iodate of sodium have been injected with apparently beneficial effect. Nothing certain can yet be stated; experiment has been too limited; but I look forward to an early future in which cataractous opacities will be treated in their initial stages by remedies applied directly to the lens, and either cleared up or absorbed, so that operation will not be, as at present, the only means available for relief.

The value of sub-conjunctival injections in detachments of the retina is at present an uncertain quantity. In the detachments which occur in high degrees of myopia there is, I fear, little hope of benefit from any treatment. And when we come to consider the conditions under which the detachment occurs, we can see why relief is attended with such difficulties. The progressive distension of the eyeball, with which myopia marches *pari passu*, attains often very considerable degree. Of the tunics which are stretched, the

sclerotic yields without tearing, but this is not the case with the choroid and retina. These tender membranes not only tear with the stretching, but become detached from the sclerotic and from each other. The condition is generally a hopeless one, because the separated membranes can never be brought to fit, speaking roughly, over the stretched sclerotic. There have been cases reported in which a certain degree of replacement and re-attachment of the choroid and retina have taken place after sub-conjunctival injections of sodium chloride solution. I have never seen this myself in myopic detachments, but in face of their lamentably hopeless character it is, I think, right to employ such injections.

In retinal detachments the result of contusions or wounds of the eyeball and of exudations poured out between the choroid and retina in choroidal inflammations, the chances of success by means of sub-conjunctival injections are much greater. Here the effect of such injections in exciting nutritive changes in the eye are proved, and solutions of chloride of sodium and cyanide of mercury are useful.

With any treatment employed for these conditions, rest in bed, lying as much as possible on the back, and bandaging of the eyes, must be maintained for a fortnight or three weeks. If no benefit follows after that time, it is not, in my opinion, worth while continuing the treatment.

In retro-bulbar neuritis, especially when due to inflammatory changes at the optic foramen or in the nerve sheath and dependant upon chill or syphilis, sub-conjunctival injections of mercurial salts have been found useful.

As to *intra-ocular* injections of solutions of mercurial salts—the perchloride and cyanide—I have but little to say. They have been recommended and tried in very serious and otherwise hopeless conditions, such as inflammations of syphilitic character affecting the deep membranes which threaten to destroy the eye; advanced sympathetic ophthalmia, and deep wounds of the globe which are taking on suppurative action. The practice has not been followed by anything but very

occasional success, and it involves great risks. But in cases which have resisted all other treatment, it may be justifiable as the last resort.

I will now take *injections into the general circulation*. Latterly enterprising therapeutists have been endeavouring to cure disease by the intra-venous injection of various solutions. And the method is strongly recommended by some foreign ophthalmologists. So far in cases of eye disease, the solutions used are those of the soluble salts of mercury, the cyanide by preference. A solution of the strength of 1 in 500 or 1000 is injected into the vein at the bend of the elbow. The technique seems simple enough. The skin of the arm is well cleansed, and one or two turns of a bandage are tightly applied over the lower part of the biceps muscle, and the vein thus made to stand out. Then a well-sterilised syringe, having a fine platinum needle, is charged with the quantity of a warmed solution, and after the needle has been warmed it is passed carefully into the vein, and the fluid slowly injected. This proceeding appears to be free from all danger. One writer claims to have done it some thousands of times with no untoward result. Even if a few bubbles of air find their way into the vein, they do no harm. After the solution has been injected, all that remains to be done is to withdraw the needle gently, and quickly apply light pressure over the wound, and then cover it with collodion. The injections may be given first in one arm and then in the other daily, or every other day, and after a series of injections, say twenty or thirty, it is deemed wise to allow of a rest for two or three weeks. The cases most benefited are those of parenchymatous keratitis, iritis, irido-choroiditis, choroiditis, and choroido-retinitis; and best and quickest results are obtained where a syphilitic taint is present.

This method is spoken of so enthusiastically by its chief exponent in the treatment of eye diseases that he says, "The intra-venous injection of soluble mercurial salts, and especially of the cyanide, constitutes the last word on the application of mercury." Without going so far as this, it may, I think, be fairly considered whether a proceeding apparently

so safe and so direct in its purpose may not be employed to aid, if not to supersede, the usual methods of the administration of mercury.

Electricity is gradually assuming a more definite and trustworthy rôle in eye treatment. At one time great things were expected of it in nerve failures and wastings, and as an aid in absorbing exudative remains. But when the first burst of enthusiasm was over, and the value of its effects came to be calmly assessed, confidence in it gradually declined, until a prominent writer said quite recently, that in diseases of the optic nerve and in eye cases generally, it acts suggestively rather than scientifically, and consequently it may be a good means to adopt because it can do no harm. Recent experiments have shown, however, that the failures in the past were due to the use of galvanic currents of one and two miliamperes only, which were too feeble to produce appreciable effects, and now, by the use of stronger currents, up to and even exceeding ten miliamperes, improvement has been obtained in cases which were before deemed hopeless. In some cases of secondary neuritic atrophy, tabetic atrophy, retro-bulbar atrophy, and in toxic amblyopia, striking improvement has been produced. We may therefore fairly regard the field of electricity in eye diseases as again open.

Massage of the eyeball is now being systematised in the tratment of some diseases of the eye. As to the changes in refractive conditions, about which there has been of late some ridiculous newspaper excitement, I shall say nothing, except that while it is conceivable that massage may, by increasing the elasticity and suppleness of the ocular tunics, and possibly of the crystalline lens, render the act of accommodation easier of performance, it is not at all likely that any actual alteration of the refraction can be produced.

There are, however, certain forms of disease of the eye and their sequelæ in which massage has been used from the earliest recorded times. In certain forms of keratitis, where there is infiltration, and in phlyctenular ophthalmia and spring and catarrhal conjunctivitis, massage with a mercurial ointment is useful after the acute stages are passed.

But massage is now being used in some of the deep-seated diseases of the eye, such as serous iritis, choroiditis, and glaucoma, with advantage. Nor is it difficult to realise when one comes to think about it, how, in these diseases, changes in circulatory and secretory and excretory processes may be produced by repeated careful massage. In glaucoma the intra-ocular tension can be lowered by massage, though the effect is only of temporary character. The mechanism by which it is brought about is said to be the following: The pressure upon the cornea compresses the iris and the lens, frees the irido-corneal angle from obstructions and adhesions, and facilitates the exit of intra-ocular fluid; and at the same time tonic action is exerted upon the ciliary muscle.

The methods of applying massage which are now recommended are three. In the corneal and other troubles, where mercurial or other ointments are used, a gentle circular movement of the fingers over the closed eyelids is best. In endeavouring to affect deeper conditions, pressure massage is used, which is exercised by the thumbs being applied over the upper eyelid and pressed from side to side for a minute or two at a time, the hands being kept steady by extending the fingers over each temple. The periods of massaging should be very short at first, and increased gradually.

Vibratory massage is also used. A small ivory button is fixed to the end of a fine flexible needle, and is set vibrating by electricity to the tune of some hundreds of vibrations per minute. These vibrations, which are exceedingly slight in the matter of force, are distributed over the front of the eye-ball through the eyelid. The effects are said to be remarkable, and especially beneficial in deep-seated disease.

Gentlemen, in this lecture I have endeavoured to place before you a brief compendium of recent progress in ophthalmic therapeutics both in materials and in methods; and I have dealt especially with the new anæsthetics—stovaine, dionine, and acoine—and the vaso-constrictor, adrenaline. I have also described the new methods of sub-conjunctival and intra-venous injections which have been devised with the

laudable intention of bringing the remedy into more immediate and direct relation with the disease. But while we welcome the new, we must not neglect the old—the remedies of which we have so abundantly proved the trustworthiness. We cannot, for instance, put aside atropine, eserine, pilocarpine, nor most of the older methods of administering mercury. But he who does not advance loses ground. Let us avoid hurry, and bear in mind the old Italian proverb, "*La diffidenza è la madre della sicurtà*—caution is the mother of safety." As for myself, my *confessio fides* in this matter may be expressed in Pope's well-known lines :—

> "Be not the first by whom the new is tried,
> Nor yet the last to lay the old aside."

REVIEWS.

The Diagnosis and Modern Treatment of Pulmonary Consumption. By ARTHUR LATHAM, M.D. (Oxon.). London: Baillière, Tindall, and Cox. Second Edition.

THIS is the second edition of Dr. Latham's monograph on Pulmonary Consumption, and as such proves the accuracy of the opinion formed on the first appearance of the work. The scope of the book is much the same as that of the first edition, the writer's object being the treatment of pulmonary tuberculosis. He therefore avoids much reference to pathology. A large portion of the book is devoted to the "open-air method," and the practical description which the author gives will enable the reader to carry out all the necessary details of the method. We cordially recommend Dr. Latham's "Pulmonary Consumption" to those who desire a reliable and practical work of convenient size.

Lectures on Diseases of Children. By ROBERT HUTCHISON, M.D. London: Edward Arnold.

WORKS on diseases of children are so numerous that any addition to the number must be of exceptional merit to gain a hearing. Dr. Hutchison's book is one that is certain to make a place for itself among its competitors, and the reputation of the writer as an authority on dietetics adds value to his "Lectures on Diseases of Children," as infant feeding is the first and chief difficulty that we meet with in this branch of medical practice. The writer's object is to describe the most common diseases of childhood, and to indicate how they should be managed. This object he has fully achieved. The

earlier chapters deal with infant feeding and the digestive disorders of childhood. The directions given for the artificial feeding of infants are characterised by a conciseness which is refreshing after the almost hopeless confusion left in the mind by the average writer, who seems to delight in percentage compositions at the expense of principles. Dr. Hutchison gives principles in such a manner that the reader can grasp the theory in a way that is certain to be of service. He puts it clearly in saying, "We may regard diluted cow's milk, condensed milk, and peptonised milk as the positive, comparative, and superlative of digestibility, so that you can adjust the diet for any particular child to his digestive power." The writer points out the beneficial results that may be obtained by the administration of small dises of grey powder in some cases where all methods of feeding fail to effect an improvement in the child's nutrition. The table of patent foods given in this chapter is well classified, and certain to be of use.

The chapter on Congenital Syphilis is an interesting one, for the writer takes a particularly wide view of the disease. He describes the "syphilitic wig," a sign of much value, but not generally known. We have often noticed it in dark-haired children, but not in the fair.

Neuroses of childhood are always an important subject, and they are here described in the broad style which is characteristic of the writer. The diseases of the respiratory organs do not receive, in our opinion, their fair share, and in some degree we feel obliged to join issue with the writer, especially as regards treatment; thus "broncho-pneumonia," one of the most important diseases of childhood, is dismissed in ten lines. We also notice that the writer advocates the use of the tent and steam inhalations, a method which many persons now condemn.

The last chapters of the book are on leading symptoms—screaming, cough, fever, etc.—and although much previously mentioned is repeated, we think the plan very good, for thus are fixed in the memory some of the most important indications of disease in childhood.

Though we differ from the writer on some minor points, we can emphatically say that Dr. Hutchison's "Lectures on Diseases of Children" is one of the most practical and instructive works we have read for some time, and we are convinced that it will be of great value in practice; and being written in a bright and simple style is a further recommendation.

REPORTS OF SOCIETIES.

BRITISH MEDICAL ASSOCIATION.

BIRMINGHAM BRANCH.

The Sixth Ordinary Meeting of the Session 1904-5 was held on Thursday, March 9th, the President, Dr. T. E. Underhill, in the Chair. There were 23 members present.

A letter of apology for non-attendance from Mr. Barling was read.

The Annual Report of the Council to the Central Council of the Association was read by the Hon. Secretary, and adopted by the Meeting.

Dermography.—Dr. Stacey Wilson demonstrated a convenient substitute for the special dermographic pencils now used for clinical purposes.

He showed that the simple device of rubbing on the skin a little zinc oxide, such as is used in the ordinary hospital dusting powder, imparts to it the quality of receiving from silver, German silver and similar metals, a good dark impression.

Skin so treated can be easily and darkly marked by a silver coin from the pocket or a German silver pencil case, and a much more satisfactory diagram can be thus drawn on it than with the ordinary blunt dermographic pencil.

He also alluded to the fact that this quality of the skin in the case of paralysed limbs was apt to be mistaken for a trophic change due to the paralysis, and explained as due to nervous influences instead of to the application of zinc dust by the nurse in the course of her usual routine. It was by the careful study of such a case that Dr. Wilson found out the true reason for dermographic skin in his cases of paralysis.

Reverberation in Abdominal Diagnosis.—Dr. Stacey Wilson demonstrated a simple form of reverberator by means of which the "bell sound" or "bruit d'airain," of well-known value in the diagnosis of phthisical cavities and pneumo thorax, could be rendered available for diagnosis of the outline and condition of the air-containing abdominal viscera. The method is modified from one of the already known methods of ausculatory percussion.

The instrument consists of a short cylindrical bone rod some one and a half inches long and three-eighths of an inch in diameter. Its lower end is rounded for close apposition to the abdominal wall or thoracic interspaces, while the upper end is flat and roughened, so that by scratching it with a finger nail loud and regular vibrations can be set up.

This little rod is held firmly between the first and second fingers, its rounded lower end pressed firmly over the viscus examined, and its rough upper end scratched with the thumb nail.

The area of the subjacent viscus is very sharply defined by the area over which the reverberation of the scratching sound can be clearly heard, with the familiar metallic ring known as the "bell sound.

Not only is this method of value in this way, but with practice much information can be gained by watching the tone of the note if the scratching is kept up continuously. Thus in ascites with distended stomach, the pitch of the reverberation can be heard to rise with each inspiration and fall with each expiration, owing to the increase in the tension of the gas in the stomach by the pressure of the descending diaphragm and the lower tension when it relaxes during expiration. But a sign of greater use is the change in the pitch of the note, which results from the peristatic action of the viscus concerned. In the case of the stomach, if at all distended, the note is heard to vary regularly as the wave of contraction passes from cardia to pylorus.

Useful information can often be gained by this same method in intestinal obstruction.

Dr. Stacey Wilson then read his paper entitled:—"The Value of an Abnormal Rise in the level of the Diaphragm as a

guide to the state of the general Circulation," of which the following is an abstract:—

Normal position of the diaphragm in health, as shown by the level of the gastric resonance and liver dulness.

Cases illustrating elevation of the diaphragm from limitation of food in gastric ulcer, enteric fever, &c.

High diaphragm in cases of anæmia, neurasthemia, &c.

High diaphragm occurring suddenly from cardiac failure in myocarditis, pericarditis, &c.

Physiological explanation of a high diaphragm.

Its clinical significance and the indications which it gives for treatment.

The paper was discussed by Mr. Freer (Stourbridge), Dr. Foxwell and Dr. Henton White, and Dr. Stacey Wilson replied.

BIRMINGHAM BRANCH.

PATHOLOGICAL AND CLINICAL SECTION.

A MEETING of this section of the Branch was held on Friday, February 24, 1905, Mr. W. F. Haslam, F.R.C.S., in the chair.

Dry Gangrene of Lower Limb.—Mr. Gamgee showed a man, aged twenty-seven years, who contracted syphilis six years ago. He was treated with mercury for twelve months. In August, 1904, he began to suffer from a feeling of "pins and needles" in the right foot. In the middle of December the right leg and foot began to "feel dead." On January 11, 1905, the right foot and lower half of the leg became affected with dry gangrene. On January 16 the foot was black and shrivelling. There was then no pulsation to be felt in the right femoral artery, and very feeble pulsation in the left, while the radial arteries felt hard and small. On January 31 a line of demarcation had formed, and so the limb was amputated through the middle of the thigh. The femoral artery and vein were both thrombosed, and further examination proved that the popliteal and both tibal arteries were also thrombosed. Microscopic examination showed thickening of the inner coats of the arteries.

Hereditary Syphilis.—Mr. Lucas showed a woman, aged between fifty and sixty years, and her grandchild, a boy, aged five years. The grandmother had been under his care for several years past suffering from gummata of the upper parts of both legs. Her daughter, when sixteen years old, was treated by him for a congenital gumma in the popliteal space, and later, when twenty years old, for ulceration of the pharynx, followed by an almost complete stricture of the naso-pharynx. The child was born when the mother was twenty-two years old, and soon after developed ulceration of the scalp and a discharge from the nose; this entirely cleared up in a fortnight under an anti-syphilitic treatment. The child now appears perfectly healthy, except for having rather prominent frontal eminences, and a depressed bridge of the nose.

Chronic Syphilitic Nephritis.—Dr. Emanuel showed a girl, aged fifteen and a half years, suffering from chronic syphilitic nephritis. The patient showed well-marked stigmata of hereditary syphilis, including Hutchinson's teeth, a depressed nasal bridge, a large square forehead with prominent frontal eminences, and disseminated choroiditis. About eight months ago she began to suffer from œdema of the face, albuminuria, and increased frequency of micturition at night. There was no history of any infectious disease, and indeed she had never been ill before in her life. She underwent the ordinary dietetic and drug treatment of Bright's disease for two months without any improvement; she was then given potassium iodide, and was permitted an unrestricted diet, and from that time the œdema and albuminuria began to disappear, and the patient gradually recovered her usual health.

Syphilis of the Lungs.—Dr. Douglas Stanley showed a woman, aged thirty-seven years, who came under his care at Queen's Hospital two years ago on account of swelling and pain in the left knee. There was a distinct syphilitic history. Physical examination of the chest showed deficient expansion on the left side; the note above and below the right clavicle was resonant, but at the level of the third rib

showed impairment of resonance. Posteriorly the note over the right apex was resonant, but became impaired in the interscapular area. On the left side anteriorly the percussion note was resonant down to the second space, posteriorly to almost the whole extent, showing only some impairment at the base. The breath sounds were distant over the right lung anteriorly and posteriorly, and a few medium crepitations were present. In the course of inquiry it turned out that the patient had previously been under treatment in hospital for "phthisis." The diagnosis was syphilitic arthritis of the left knee and chronic syphilitic pneumonia. About ten days after coming under observation the patient had hæmoptysis, the expectoration being dark red and glairy. This lasted for several weeks. The sputum was examined frequently for tubercle bacilli, but none were ever found. The lung signs rapidly improved under iodide, and the patient put on weight.

Lupus of Upper Air Passages.—Dr. Wilfrid Glegg showed a girl, aged nineteen years, with lupus of the upper respiratory passages. She had one small patch, under ½in. in extent, on the left side of her face. The inferior turbinals and parts of the nasal septum, and the palate, pharynx, and larynx are involved, but the epiglottis did not show signs of the disease. There was an entire absence of general constitutional symptoms, and there were no physical signs in the lungs. The duration of the disease was about three years.

Syphilitic Ophthalmoplegia.—Dr. Douglas Stanley showed (for Mr. Wilfrid Allport) a man, aged forty-four years, who attended hospital as an out-patient on June 17th, 1904. Seven weeks previously he had severe facial neuralgia, for which he had several decayed teeth extracted. He then noticed that the left side of the face felt numb, and that he had double vision. On examination he was found to have complete paralysis of the external rectus muscle of the left eye, with the usual homonymous diplopia. There was no definite history of rheumatism or syphilis, but the presumption was in favour of the latter. His vision at that time was full in both eyes, and the fundi were perfectly normal. He

was treated with potassium iodide, and later with that drug combined with mercury, and had the galvanic current applied daily, until the end of July, when he developed ptosis of the left eyelid, and remained in this condition until September, when he displayed complete ophthalmoplegia externa, but with no defect of vision. His knee-jerks were normal. Following this his sight began to fail rapidly until October, when, in addition to the former symptoms, he was found to have ophthalmoplegia interna. At this time there was no marked change in the fundus. In November he had some anæsthesia in the left supra-orbital region, but in no other area. During this time he was treated with mercury in various forms—by the mouth and by inunction—but no improvement resulted; he was perfectly blind in the left eye, and regained no muscular power in the eye muscles until recently, when the external rectus became slightly active, and the ptosis began to gradually recover. At the present time he had a fair amount of power in the external rectus; he could raise the lid a little, and his condition was certainly improving, though his sight was gone, and the optic nerve showed marked atrophy. The case is apparently one of gummatous infiltration at the back of the orbit, involving the third, fourth, sixth, and optic nerves.

Charcot's Ankle.—Mr. Billington showed a case of Charcot's ankle in early general paralysis of the insane. The patient was a man, aged thirty-seven years, who had led a dissipated life for many years. Ten years ago he had had gonorrhœa, and two years ago he was treated for syphilis at a skin and lock hospital. So far as could be ascertained, he then had a primary sore. Until the last six months—during which time he had been a teetotaller—for years he consumed upwards of a pint of spirit a day. Four years ago an attack of cerebral thrombosis left him partly paralysed down the right side. The paralysis lasted several months, and right-sided movements were still performed slowly and awkwardly. The grip on the right side was distinctly weaker than on the left. For two or three years he had had lightning pains in both legs. Six months ago his memory began to fail, and

for two or three months he had complained of precipitate micturition and occasional incontinence of urine. Two months ago the left ankle suddenly and without trauma became swollen; at first there was some pain, but this soon subsided. The ankle had remained swollen and felt weak when weight was put upon the foot. The face was rather expressionless and apathetic, but not asymmetrical. The eyes were a little unsteady, but there was no nystagmus and no diplopia. The pupils were equal and reacted to accommodation, but not to light. The tongue was tremulous, and protruded a little to the right side. The arm jerks and knee jerks were exaggerated on both sides; the plantar reflex on the right side was extensor and on the left side flexor. On both legs were considerable areas of analgesia. No ataxia and no Romberg's sign. The left ankle was much swollen, and the foot was displaced outwards and everted, so that the patient walked on the inner border. There was excess of fluid in the joint, and considerable bony thickening around. It was not painful or tender.

Dr. Foxwell read a note on a case of renal syphilis. He drew attention to the great œdema and anæmia, with absence of any sense of illness. The urine had a specific gravity of 1025 to 1030, a very large amount of albumen (up to 2 per cent.), quantity about 45oz., and urea 1.5 per cent. Neither casts nor cells were ever seen. Under one grain of grey powder and five grains of iodide of potash thrice daily, the œdema rapidly vanished, and the heart, which had been dilated with rapid action, quickly recovered its tone. Yet the urine was, if anything, worse than it was when first examined six months ago, though the patient felt quite well and was actively engaged as a schoolmaster. Syphilis was contracted in July, 1903, but the urine, though previously examined, was not noted to be albuminous till June, 1904. The literature of the subject points to the conclusion that the earlier the kidneys are affected, the shorter the duration of their affection: if this affection do not arise for one to two years after the primary infection, it is apt to be permanent. The peculiar character of the urine in this case does not correspond with

that of any recognised form of renal disease, but Drs. Bostock and Emanuel reported a similar urine in the *Birmingham Medical Review* for 1902, where, after death, the lesion was found to be one of lardaceous degeneration.

MIDLAND MEDICAL SOCIETY.

A MEETING of this Society was held at Birmingham on February 15, the President, Mr. Wood White, being in the chair.

Dr. Emanuel showed an infant of six weeks, suffering from paralysis of both arms, caused at birth. The mother was a primipara aged thirty-two years. The child was full term, the pelvis a little contracted, and the head presented. The accoucheur, failing to deliver with forceps, turned and delivered the trunk, shoulders, and arms without difficulty. The after-coming head, however, became impacted, and great force was expended in its delivery by pulling on the trunk with the help of a towel wrapped round the shoulders. The day after birth, complete paralysis of both upper limbs was noted. Two weeks later movements in the fingers of the left hand were observed. A month later the left arm showed typically the condition seen in Duchenne's birth paralysis, as a result of rupture of the fifth and sixth cords of the brachial plexus; but the right extremity had undergone no improvement, and evidently the brachial plexus on this side was severely damaged.

Mr. Gamgee proposed to wait till the infant was two months old, and then, if the right arm still showed no improvement, to attempt suture of the divided cords of the plexus.

Dr. Thomas Wilson showed (1) a specimen of cancer of the cervix uteri with pyometra. (2) A specimen from a case of tubal gestation, showing an oval enlargement of the broad ligament due to hæmorrhage into an early ovum; the tube was continued over the surface of the hæmatoma, from which its lumen was free.

Mr. Billington read a paper on "Some Points in the Treatment of Tubercular Disease of the Hip."

Dr. Douglas Stanley showed a girl, aged ten years, who first came under his care in February, 1904. She was then wasted, and suffered from cough, dyspnœa, and abdominal pain. Some months previously Mr. Billington removed a portion of the right second metacarpal bone on account of tubercular disease. When she came under medical treatment she had extensive tuberculosis of the left lung, the upper half of which was consolidated. There were signs of early infiltration of the right lung. The abdomen was enlarged and tender; and, on examination, a centrally-placed mass, with ill-defined margins, could be felt; there was also fluid in the cavity, which was not free. The family history showed that the patient's father died of "rapid consumption," and one sister (now, 1905, under treatment) is the subject of lung tubercle. The patient was sent to Bournemouth. Seen a year later, she appeared rosy and fat; the signs on the left side of the chest showed adhesion and retraction of the lung; the right lung was clear; so was the abdomen. There was no cough.

A Meeting of this Society was held at Birmingham, on Wednesday, March 1st, the Chair being occupied by the President, Mr. E. Wood White.

Dr. J. W. Russell showed a case of Acromelagy. Mr. Gamgee showed a man, aged 46, the subject of Adiposes Dolorosa. The disease had been in existence for 5 years, and the patient had symmetrical masses of fat at the back of the neck, a mass in the right axilla and a large one in the subcutaneous tissue of the abdominal wall. The tumours were softer and of less definite outline than ordinary lipomata, while those in the axilla and abdominal wall were very tender on pressure. One of the tumours on the back of the neck was the seat of severe neuralgic pains. There was no abnormal pigmentation of the skin over the

tumours and there had not been any subcutaneous hæmorrhages. The patient was a confirmed alcoholic. Attention was called to the fact that this disease very rarely occurs among males.

Dr. Jameson Evans showed an eye which contained a large Melanotic Sarcoma which had penetrated the Sclerotic at the corneal limbus. Before the removal of the eye the large extraocular mass had projected between the eyelids on to the cheek.

The specimen was of interest because

1. The growth had arisen in an eye the sight of which had been destroyed by an accident three years previously.

2. The comparative mildness of the symptoms before the growth perforated the globe and the rapidity of the growth afterwards. For six months (when the tumour must have been present though not diagnosed owing to opacity of the lens) the only symptoms were slight ciliary injection of a cystoid cicatrix at the site of subsequent perforation. There never was increased tension whilst he was under observation. According to the man's statement the extraocular growth grew to the size of a walnut in three weeks.

3. The patient is now (ten months after excision) suffering from metastatic growths in lungs, liver, and in skin of face, chest, abdomen and extremities—the number of growths on the surface being over 200.

Mr. J. W. Taylor read a Paper on the Value of Colpotomy in the Thrombotic Form of Puerperal Fever (early Thrombotic Pyæmia).

BOOKS RECEIVED.

From John Wright and Co., Bristol—
Medical Annual, 1905.
Errors of Refraction. By CHARLES BLAIR, M.D.

From J. and A. Churchill, London—
Abdominal Pain. By A. ERNEST MAYLARD, M.B., B.S.

From Baillierè, Tindall, and Cox, London—
Principles and Practice of Asepsis. By ARTHUR STYLES VALLACK, M.B.
Surface Anatomy. By E. GILLMAN MOORHEAD, M.D.

From H. K. Lewis, London—
The Sanitary Inspector's Handbook. By ALBERT TAYLOR.

From Edward Arnold, London—
Lectures on Diseases of Children. By ROBERT HUTCHISON, M.D.

From John Bale, Sons, and Danielson, London—
The Radical Cure of Corns and Bunions. By E. HARDING FREELAND, F.R.C.S.

From J. W. Arrowsmith, Bristol—
Medical Philology. By L. M. GRIFFITHS, M.R.C.S.

From Rebman, Ltd., London—
The Effects of Tropical Light on White Men. By MAJOR C. E. WOODRUFF, M.D.

PHYSICAL CHEMISTRY AND ITS APPLICATIONS IN MEDICAL AND BIOLOGICAL SCIENCE.*

By ALEX. FINDLAY, M.A., Ph.D., D.Sc., *Lecturer on Physical Chemistry in the University of Birmingham.*

WHEN we look back on the course of development of any of the branches of experimental science, we always observe that the progress of development is a discontinuous one, consisting of periods during which a rapid and vigorous development is succeeded by slower and feebler growth. Each of these generations in the life of the science begins with the conception of a new hypothesis and the birth of a theory which not only enables us to see the line of co-ordination binding together the isolated results of experimental enquiry, but also sends a beam of light, more or less intense, into the darkness of the unknown, thereby revealing paths along which further advance can be made. As advance proceeds farther and farther from the source, the light becomes fainter, and many facts and phenomena are encountered which are imperfectly illumined, and remain only partially understood until they also are lit up by the radiance of a new theory.

Thus it is that the great development in the study of solutions dates from the time when, in 1886, the Dutch chemist and physicist, van't Hoff, put forward his theory of solutions, and when, in the following year, the Swedish physicist, Arrhenius, propounded his theory of electrolytic dissociation of salts in solution. Not only did these twin theories co-ordinate a large mass of isolated facts and phenomena which were imperfectly understood, but they also opened up a new and large world for scientific investigation. Nor has the development which has taken place as the result of these theories been confined to physical chemistry; almost all the other experimental sciences have been markedly affected.

* Being a Course of seven Lectures delivered in the University of Birmingham, during the Spring Term, 1905.

Since the laws of solution are nowhere of more importance than in connection with the animal and vegetable world, it is not surprising that the theories of van't Hoff and Arrhenius should have exercised an important influence on the development of medical and biological science. Thus we find that whereas, formerly, the function of biological chemistry was to investigate the nature of the compounds existing in plants and animals, and to discover the methods of isolating and producing them; recently, attention has been increasingly paid to the study of the vital processes taking place in the organisms, more especially in relation to the nature of the various solutions constituting the different body fluids of animals and the cell sap of plants. That work of great interest and importance has already been accomplished in this direction is known to every student of the biological sciences. One only requires to recall the work of Pfeffer and of de Vries on the application of the laws of osmotic pressure of solutions to the study of the movements and growth of plants; of Hamburger, on the hæmolysis of the red blood corpuscles; of Mascart and of Vladimiroff, on the relations between the osmotic pressure of solutions and their chemotactic influence on bacteria; as well as the similar experiments of Pfeffer on the spermatozoa of cryptogamic plants; and lastly, the almost startling experiments of Loeb on the influence of osmotic pressure and of certain ions in the production of artificial parthenogenesis.

In thus furthering the advance of biology, physical chemistry was only paying a debt which it owed to the biological sciences themselves; for it was largely owing to the experimental work of the botanist, Pfeffer, and of other biologists, that van't Hoff was able to establish his theory of solutions. While this is so, it can, however, also be said that the debt has been paid with interest, for by the introduction of the theories of solution, a development was assured to the biological sciences such as they probably would not otherwise have attained. That in this way the two branches of science—the physical and the biological—have been so mutually helpful, cannot but give the greatest satisfaction to all scientific workers.

In view of the great influence which physical chemistry is exercising on the development of the biological sciences, it was with great pleasure that I undertook, at the request of some of my colleagues, to give a short account of some of the more important theories and methods of physical chemistry, and to indicate some of the problems to the study of which these have been applied.

As it is probably the theories of solutions that have exercised the greatest influence on the biological sciences, it is with the properties of solutions that I propose chiefly to deal, and pass on in the first place to consider

DIFFUSION AND OSMOTIC PRESSURE.

When two gases are brought into contact, then, as you are aware, diffusion takes place—the one gas passes into the other—and this process continues until the whole gas mixture has become uniform in composition throughout. Thus, the light gas hydrogen will diffuse *downwards* into the heavy gas carbon dioxide, and the latter will diffuse *upwards* into the hydrogen. This process is rendered very evident by placing a small quantity of bromine at the bottom of a cylinder containing air. In a few minutes it will be seen that the bromine vapour, although more than five times as heavy as air, has passed up to the top of the cylinder. The driving force of this process is the difference of the partial pressures of the two gases at the different parts of the vessel.

A similar process also occurs in the case of substances in solution. If two solutions of different substances, or of the same substance but of different concentration, are brought into contact, diffusion also takes place, although much more slowly than in the case of gases; and this process also continues until the solutions become of uniform concentration throughout. This diffusion can be easily shown with a test-tube filled with a solution of gelatine to which a little phenolphthalein has been added, and placed mouth downwards in a dish containing a solution of caustic soda. The alkali diffuses up into the tube and reddens the phenolphthalein. I have chosen the experiment in this form because

of the fact—a fact of importance in physiological work—that the addition of gelatine, agar-agar, and other substances of the same nature scarcely affects the velocity with which diffusion of salts and crystalloids takes place, although it prevents, or almost entirely prevents, the diffusion of other gelatinous or colloidal substances. The presence of the gelatine is also of value in that it prevents mixing by means of convection currents.

This diffusion of dissolved substances can also be shown by means of the familiar apparatus, the dialyser. If a solution of salt is poured into a vessel closed by means of parchment paper and placed in water, we find that after a short time some of the salt has passed through the parchment into the pure water, and this process will continue until the concentration of the salt is the same outside and inside the dialyser. In the case of gases the driving force we saw was the difference of the gas pressures; in the case of solutions the driving force is called the *osmotic pressure.*

How can this osmotic pressure be measured? If we place the dialyser with the salt solution in a vessel of pure water, we shall find that water will pass into the dialyser faster than solution passes out, so that the level of the solution will rise and produce a hydrostatic pressure. This is the phenomenon of endosmosis. The height to which the liquid rises, however, cannot be taken as a measure of the osmotic pressure of the solution, for the level of the liquid never remains stationary, but after reaching a certain height begins to fall again, until the levels outside and inside the vessel are the same. If we placed in the dialyser or endosmometer different solutions having the same osmotic pressure, we should find that the level to which the liquid rose was different in the different cases. The production of a pressure is to be ascribed to the difference in the velocity of diffusion of the dissolved substances through the membrane. The greater the velocity of diffusion, the lower will be the level to which the liquid inside the endosmometer will rise. We must therefore distinguish between the temporary pressure produced owing to the difference in the velocity of diffusion and

the osmotic pressure. Both are of importance, and both may play a rôle in the processes of absorption and secretion.

Before we can measure the osmotic pressure of a solution, it will evidently be necessary to procure a membrane for the endosmometer which will allow the water to pass freely through, but will prevent the passage of the dissolved substance. Now, as you are all aware, it was found by Graham, many years ago, that parchment paper or animal membrane, such as pig's bladder, will allow water and dissolved salts to pass, but will prevent the passage of substances such as starch, albumen, and other so-called colloidal substances. Such a membrane, which is permeable to the solvent but not to the solute, or dissolved substance, is called *semi-permeable;* and we should therefore say that parchment paper is semi-permeable to a solution of albumen. If, then, we close the mouth of the endosmometer with parchment paper, and fill the vessel with a solution of albumen, the height to which the water will rise on immersing the endosmometer in water will measure the osmotic pressure of the albumen solution. The pressure in such a case is, for reasons which we shall learn presently, very small, amounting in the case of a 10 per cent. solution to only 0.17 atmospheres. Moreover, colloidal solutions are a special class of liquids differing in many respects from ordinary solutions, such as a solution of sugar or of salt; and it is not at all certain that the pressure which one really measures is the true osmotic pressure of the solution, in the same sense in which one uses this expression in the case of solutions of crystalloids.

However that may be, a parchment membrane cannot be employed for the determination of the osmotic pressure of solutions of crystalloids, because, as we have seen, these pass through the membrane. The first membranes semi-permeable for salts, were discovered in the thin membranes surrounding animal and vegetable cells, and the phenomena of osmosis were first studied by means of these. It was, however, at a later date, discovered by M. Traube that certain inorganic precipitates are semi-permeable with respect to the salts from which they are formed, and semi-permeable also

with respect to many other dissolved crystalloids. Such a semi-permeable precipitate is, for example, copper ferrocyanide. When a solution of copper sulphate is mixed with a solution of potassium ferrocyanide, a brown precipitatate of copper ferrocyanide is produced, $2\ CuSO_4 + K_4Fe(CN)_6 = Cu_2Fe(CN)_6 + 2\ K_2SO_4$, and this precipitate, while it will allow water to pass through, will prevent the passage of either copper sulphate or of potassium ferrocyanide, as well as of a number of other salts and crystalloids. Before such a precipitate could be employed for the investigation of osmosis, it had to be obtained in a coherent form as a membrane, and this Traube accomplished in the following manner. A strong solution of copper sulphate was allowed to run into a weak solution of potassium ferrocyanide. Immediately the copper sulphate came in contact with the solution of potassium ferrocyanide, a film of copper ferrocyanide was formed which enclosed the solution of copper sulphate, as it were, in a small pouch, depending from the surface of the potassium ferrocyanide solution.

Although Traube made a number of investigations of osmotic phenomena with the aid of these cells, it was not possible for him to actually determine the value of the osmotic pressure, because the thin membrane of copper ferrocyanide which was produced was, of course, too weak to sustain the high pressures which, as we shall presently learn, are obtained. The problem therefore arose as to how such membranes, in spite of their weakness, could be employed for the measurement of pressures amounting to several atmospheres. This problem was solved by the botanist, Prof. Pfeffer. Pfeffer took an ordinary battery pot of porous biscuit ware, and, after replacing the air contained in its pores by water, he filled it with a solution of copper sulphate and placed it in a solution of potassium ferrocyanide. Since the pot was, of course, permeable for both these salts, diffusion took place, the copper sulphate passing towards the outside of the pot, and the potassium ferrocyanide towards the inside. Somewhere within the walls of the pot the two salts would come together, and there form a precipitate of ferrocyanide. In this way a membrane was formed which was

supported by the material of the pot, and which was thereby enabled to withstand considerable pressures. After being well washed, the pot was ready for use. A sketch of the apparatus is shown in Fig. 1. The porous pot, *z*, containing

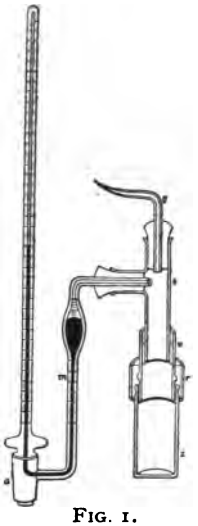


FIG. 1.

the solution the osmotic pressure of which was to be measured, was connected with a closed manometer, *m*, by means of the tube *t* and the collars *v* and *r*. The pot was then placed in pure water kept at constant temperature. In the course of a short time the pressure inside the pot is shown by the manometer to increase, and ultimately to become constant. The constant pressure thus produced represents the osmotic pressure of the solution.

With this apparatus, Pfeffer carried out a number of determinations of osmotic pressure, and the pressures which he found were, even in the case of fairly dilute solutions, very considerable. Some of his results are given in the following table :—

TABLE 1.

SOLUTIONS OF CANE SUGAR. TEMPERATURE ABOUT 14°C.

Concentration by Weight.	Pressure.	Pressure. Concentration.
1 per cent.	53.5 cm.	53.5
2 ,,	101.6 ,,	50.8
4 ,,	208.6 ,,	52.0
6 ,,	307.5 ,,	51.2

The numbers in the above table show that the osmotic pressure is directly proportional to the concentration. But the osmotic pressure also increases as the temperature is raised, as is shown in the following table giving the osmotic pressure of a 1 per cent. solution of cane sugar at different temperatures :—

TABLE 2.

Temperature.	Pressure.
14.2°	51.0 cm. Hg.
15.5°	52.1 ,,
32.0°	54.4 ,,
36.0°	56.7 ,,

Such is some of the experimental material accumulated by Pfeffer and utilised by van't Hoff in establishing his theory of solutions. According to this theory, *a substance in solution behaves as a gas occupying the same volume as the solution; and the laws which substances in solution obey are analogous to those which are followed by gases.* Let us just briefly recall what these gas laws are :—

(1) The first of these is that known as Boyle's law. This states that if the temperature is maintained constant, the pressure of a gas is inversely proportional to the volume occupied by it. If the volume is halved, the pressure is doubled; if the volume is doubled, the pressure is halved.

(2) The second law is that known as Dalton's or Gay-Lussac's law, which states that when the pressure on a gas is maintained constant, the volume increases as the temperature is raised, and in exactly the same way for all gases, viz., every gas expands by $\frac{1}{273}$ of the volume which it would possess at 0° for each degree rise of temperature. For the practical calculation of volumes, this law becomes simpler when stated in the form, that if the pressure is constant, the volume of a given amount of gas is directly proportional to the *absolute temperature*, that is, to the temperature measured from a point 273° below zero centigrade. Temperatures measured on this absolute scale, which we shall represent by T, will therefore be equal to the temperatures measured on the Centigrade scale plus 273°. If, now, we express the above law in symbols, we obtain $v : v' = T : T'$.

If, therefore, the volume is 1 litre at the temperature 273° A., *i.e.*, at 0°C., then, if the pressure is maintained constant, and the gas therefore allowed free expansion, the volume will be 2 litres when the absolute temperature is 546°, *i.e.*, at 273°C.

On the other hand, if the volume of the gas is maintained constant, the gas therefore not allowed to expand, then the pressure of the gas will increase in exactly the same way as does the volume when the pressure remains constant; in other words, the pressure which a given amount of gas exerts is proportional to the absolute temperature. That is: $p : p' = T : T'$.

(3) The third regularity which is observed in the case of gases is that summed up in the postulate of Avogadro. This very important postulate can be stated indirectly in the words: Under the same conditions of temperature and pressure, the gram-molecular weight of all gases occupies the same volume. By gram-molecular weight (also called a mole) is meant the molecular weight expressed in grams. Thus, the molecular weight of hydrogen is 2; a gram-molecule or mole of hydrogen is therefore 2 grams. In the case of nitrogen it is 28 gm.; of oxygen, 32 gm., and so on. If we choose the temperature of 0°C., and the pressure equal to one atmosphere, or 760 mm. of mercury, then it is found that the volume occupied by a gram-molecule of all gases is 22.4 litres. Therefore, 2 gm. of hydrogen, or 28 gm. of nitrogen, etc., at 0°C., and under the pressure of one atmosphere, occupy the volume of 22.4 lit. Knowing this, we can, of course, calculate, with the help of Boyle's law, what the volume would be under any other pressure; and with the help of Gay-Lussac's law, what the volume would be at any other temperature. Thus, if the pressure is 750 mm., and the temperature is 15°C., then the gram-molecular weight of any gas would occupy $\frac{22{\cdot}4 \times 760 \times 288}{750 \times 273} = 23{\cdot}95$ litres.

Further, since the volume occupied by a gram-molecule at 0° under atmospheric pressure is 22.4 lit., it follows that if we diminish the volume to one litre, the pressure will be 22.4 atmospheres. That is to say, *the pressure which is exerted by a gram-molecule of any gas when it occupies the volume of one litre at 0°C. will be 22.4 atmospheres.*

It is of essential importance to bear these laws in mind, because, according to the theory of van't Hoff, a substance in solution behaves as if it were a gas, and obeys analogous laws. In this case the volume of the solution corresponds with the volume of the gas, and the osmotic pressure of the solution with the gas pressure. This theory of van't Hoff we shall now proceed to test.

First of all, with regard to Boyle's law, that the pressure is inversely proportional to the volume. Let us again consider the values which Pfeffer obtained for the osmotic pressure of solutions of cane sugar (Table 1). With a 1 per cent. solution—that is, a solution containing 1 gm. dissolved in 100 gm. of water—the osmotic pressure was 53.5 cm. of mercury. If, now, we have the same amount of sugar in half the volume, *i.e.*, if we have a solution containing 1 gm. dissolved in 50 gm. of water (that is to say, a 2 per cent. solution), then if Boyle's law holds for dissolved substances the osmotic pressure ought to be 107 cm. mercury. Pfeffer found 101.6 cm. If we take a 4 per cent. solution, *i.e.*, if we make the volume in which 1 gm. of sugar is dissolved equal to one-fourth of the original volume, then the pressure ought to be 214 cm. Pfeffer found 208.6 cm. And so on. We see, then, that there is very fair agreement between the calculated values of the osmotic pressures, and those determined experimentally by Pfeffer. That the agreement is not better is to be ascribed to inaccuracies in the determinations, because other more accurate methods give results which confirm the law. (It may be mentioned that accurate measurements of the osmotic pressure by the method used by Pfeffer are exceedingly difficult; and further, the temperature in Pfeffer's experiments was not quite constant.) We can therefore say that Boyle's law for gases can be applied also to solutions, and state that, for a given amount of dissolved substance, the osmotic pressure is inversely proportional to the volume of solution. That is the same as saying that *the osmotic pressure is, for any given substance, directly proportional to the concentration of the solution.*

With regard, in the second place, to the effect of temperature. In the case of gases, the pressure of a given amount of gas is proportional to the absolute temperature. In the case of solutions, the analogous law would be: *The osmotic pressure of a solution of given concentration is proportional to the absolute temperature.* This law also is found to be true. Thus we saw (Table 2) that at 14.2° the osmotic pressure of a 1 per cent. solution of cane sugar is 51 cm. If the law just stated is true, then the osmotic pressure of the same solution at, say, 32°, should be (since 14.2° C = 287·2° A, and 32° C = 305° A), $\frac{51.0 \times 305}{287.2} = 53.4$ cm. Pfeffer found 54.4 cm. Here again, therefore, we see that the osmotic pressure of solutions follows the same law as the gaseous pressure of a gas.

Lastly, with regard to the postulate of Avogadro. For gases we saw that at a temperature of 0°C., one gram-molecule of a gas exerts a pressure of 760 mm. of mercury when it occupies a volume of 22.4 lit., or 22,400 cc. The analogous law applied to solutions would be: At a temperature of 0°, the osmotic pressure of a solution would be 760 mm. (1 atmosphere), when it contains one mole of dissolved substance in 22,400 cc. of solution. We can test this as follows: One gram of cane sugar dissolved in 100 gm. of water gives a solution having the volume 100.6 cc. The molecular weight of cane sugar is 342. Therefore, 100.6 cc. of solution contain $\frac{1}{342}$ mole of cane sugar, and, therefore, 22,400 cc. will contain $\frac{22400 \times 1}{100.6 \times 342} = 0.652$ mole. The osmotic pressure of this solution at 0° was found by Pfeffer to be 49.3 cm.; therefore, according to our first law, the osmotic pressure of a solution containing one mole in 22,400 cc. would be $\frac{49.3 \times 1}{0.652} = 75.6$ cm., which agrees very well with the theoretical value, 76 cm. Other substances give similar results, and hence we can state the very important law that at any given temperature all solutions which contain the same number of gram-molecules in the same volume have the same osmotic pressure; or, in other words, *equimolecular solutions of all substances are isosmotic.*

We shall see later that acids, bases, and salts are apparent exceptions to this rule; but we shall also learn how the behaviour of these substances can be brought into line with that of organic substances like cane sugar.

If the concentration of the solution is expressed not in gram-molecules per litre, but in grams per litre, then it follows that in solutions containing the same number of grams per litre, the osmotic pressure will be inversely proportional to the molecular weight. Thus, for example, if we have a substance of molecular weight 10, and another of molecular weight 40, and make solutions of each containing 10 gm. in a litre, the solution of the former substance will contain one mole, while the solution of the latter will contain only a quarter mole per litre. The osmotic pressure of the second solution will therefore be only one-fourth that of the first. The following table illustrates this :—

TABLE 3.

Substance.	Molecular weight.	Molar concentration* of a 10% solution.	Osmotic pressure in atmospheres.
Methyl alcohol ...	32	3.125	70.00
Urea	60	1.667	37.34
Grape sugar	180	0.555	12.43
Cane sugar	342	0.292	6.54
Albumen	13,000	0.008	0.17

(With regard to the osmotic pressure of the solution of albumen, it must be said that this cannot be taken as confirmation of what was stated above, because the molecular weight ascribed to albumen has been calculated from the osmotic pressure.)

It will further be observed from the above table that the osmotic pressure of a solution containing one mole in one litre will be equal to 22.4 atmospheres, which is analogous to what we found in the case of gases.

The importance of the law which has just been stated consists, of course, in the fact that if we know the molecular weight of a substance, we can at once calculate how much of it must be dissolved in a litre in order to give any desired osmotic pressure.

* That is, concentration expressed in moles per litre.

CRYOSCOPIC METHOD OF DETERMINING THE OSMOTIC PRESSURE.

Although, in discussing the laws of osmotic pressure, we have made use of the numbers obtained by direct measurement of the pressure in an osmotic cell, this method of determining the osmotic pressure of a solution is not a convenient one, and is never employed for ordinary purposes. The method which is almost exclusively used is the cryoscopic one, or the determination of the freezing point of the solution.

The principles on which this method is based are that when a solution begins to freeze, only pure ice, free from the dissolved substance, separates out; and that the temperature at which a solution freezes is lower than that at which pure water freezes. That is to say, the freezing point of water is depressed by solution in it of any substance, and the amount of the depression is proportional to the amount of dissolved substance.*

The importance of the cryoscopic method of determining osmotic pressures depends on the fact that solutions containing the same number of gram-molecules of dissolved substance in the same volume give the same depression of the freezing point. Thus, in the case of all substances (always excepting acids, bases, and salts), the depression of the freezing point of water when one gram-molecule of the dissolved substance is contained in 1 litre of the solution, is 1.85°C. Since the depression of the freezing point is proportional to the molar concentration of the solution, all solutions containing an equal number of gram-molecules in the same volume, freeze at the same temperature. In other words, *equimolecular solutions have the same freezing point.* But we have seen that equimolecular solutions are isosmotic; hence, solutions having the same freezing point are isosmotic.

It will be easy to see from this that determinations of the freezing point of solutions will enable us to calculate the osmotic pressure of the solution. Thus, we have seen that a solution containing one mole of dissolved substance in one litre causes a depression of the freezing point of 1.85°; and

* I omit here the description of the apparatus and of the special thermometer usually employed in carrying out this determination, as they can be properly understood only by actual acquaintance with the method in practice.

we have also learned that a solution of this concentration would have an osmotic pressure of 22.4 atmospheres. Since the osmotic pressure and the depression of the freezing point are each proportional to the molar concentration, we can calculate by simple proportion the osmotic pressure of a solution, the freezing point of which is known. Thus, the freezing point of human blood plasma has been found to be on an average, —0.56°. Since a depression of 1.85° corresponds with an osmotic pressure of 22.4 atmospheres, the osmotic pressure of blood plasma will be $\frac{22.4 \times 0.56}{1.85} = 6.77$ atmospheres.

Emphasis may again be laid on the fact that it is not the percentage composition of the solution that is of value in giving the measure of the osmotic pressure or the depression of the freezing point, but the *molar concentration*, or the number of moles (gram-molecules) of dissolved substance in a given volume (1 litre) of the solution. Ordinary chemical analysis, therefore, which gives the percentage amount of dissolved substances, does not indicate the value of the osmotic pressure. For example, blood plasma contains about 9 per cent. of albuminoid substances, and about 0.8 per cent. of inorganic salts. But the freezing point of the plasma and of the serum, after removal of the albuminoids, is practically the same, so that the depression of the freezing point is due almost entirely to the inorganic salts. The reason of this is, of course, that the albuminoids have a very high molecular weight, so that a relatively very great amount of them by weight is required in order to produce even a comparatively small depression of the freezing point.

STUDY OF OSMOTIC PRESSURE IN PLANTS AND ANIMALS.

Turning from the consideration of the laws of osmotic pressure and the physical methods by which the osmotic pressure can be determined, we shall now consider some measurements of the osmotic pressure in the case of plants and animals. The first point which we shall take up is the osmotic pressure of cells, both vegetable and animal.

In investigating the osmotic pressure of the protoplasm of plant cells, the method most employed is the plasmolytic

one, due chiefly to de Vries. In the case of many plant cells we find the cell surrounded by a sheath of cellulose, within which is the protoplasm surrounded by its membrane. When the cell dies, the protoplasm separates from the cellulose sheath, and the dissolved constituents of the cell sap pass out through the dead membrane. The same phenomenon—the separation of the protoplasm from its sheath—is observed when the living cell is placed in solutions the osmotic pressure of which is greater than a certain value. This is the phenomenon of plasmolysis. In the normal condition the protoplasm lies close to the cellulose wall, and maintains this in a certain state of tension. When the cells are brought into a strong salt solution, the osmotic pressure of which is greater than that of the cell sap, the cell contracts (owing to the passage outwards of water), and becomes flaccid. The protoplasm is here surrounded by a membrane which is semi-permeable, allowing water to pass through, but not dissolved substances; or in any case it prevents the passage of many dissolved substances. By bringing cells into solutions of different concentration, we can find out the concentration at which plasmyolysis ceases. We then know that we are dealing with a solution which is isosmotic with the cell sap and the cell contents; and if we determine the osmotic pressure of this particular solution (by the croyscopic method, for example), we learn the osmotic pressure of the cell sap. Further, since solutions which are isosmotic (or isotonic) with the cell sap must also be isosmotic with one another, the method gives us a means of determining when solutions are isosmotic. But, on the other hand, having once determined the concentration of one solution which is isosmotic with the cell sap at a given temperature, we can calculate the concentration which the solution of another substance must have in order also to be isosmotic with the cell sap, provided we know the molecular weight of the substance in solution.

The turgidity or stiffness of plant stems, for example, is to be referred to the existence of the osmotic pressure in the cells. It will be increased by placing these in water or solutions of lower osmotic pressure than the cell sap (water

will pass into the cells), and diminished by placing them in solutions of greater osmotic pressure (because water will now pass out from the cells).

Red blood corpuscles have also been employed in a similar manner for the determination of isosmotic solutions. When red blood corpuscles are placed in a strong salt solution, they shrink up and become crenated; when placed in pure water, they burst, and the red colouring matter is allowed to pass into the water. This again is due to the corpuscles being surrounded by a layer which acts as a semi-permeable membrane. If the liquid in which they are placed has a lower osmotic pressure than the contents of the corpuscle, water will pass into the latter and cause the corpuscle to swell and finally burst. If the osmotic pressure is higher, water will pass out from the corpuscle, which will therefore shrink.

It must be borne in mind, however, that solutions which cause the bursting of the corpuscles are not really isosmotic with the contents of the latter. The membrane surrounding the corpuscles has a certain power of resistance, and therefore a certain difference of osmotic pressure will be necessary to cause its rupture. In order, therefore, to determine when a solution is really isosmotic with the corpuscle contents, we must ascertain the concentration which causes no change in the volume of the corpuscle. This is accomplished by means of the hæmatocrite. This consists of a small graduated capillary tube opening out at the top into a funnel-shaped expansion, to which a small syringe can be attached. A certain volume of blood is drawn up into the capillary, and after closing the two ends by means of caps, the tube is placed in a centrifuge. On being centrifugalised, the blood corpuscles collect at the end of the tube, forming a column of definite length which is read off. The hæmatocrite is then cleaned out, a fresh quantity of blood drawn up to the same mark as before, and then, following this, a quantity of the solution to be tested. The two liquids are mixed with a fine needle, and then centrifugalised as before. If the solution was hyposmotic, the length of tube occupied by the

corpuscles will now be greater than in the first case; if the solution was hyperosmotic, it will be less. When the osmotic pressure of the solution is the same as that of the blood corpuscles, the volume occupied by the latter will be the same as when no solution was introduced.

Take the following example. With blood alone, the height of the column of corpuscles was, in four experiments, 52.5, 52.2, 52.5, 52.0; mean, 52.3. When mixed with solutions of cane sugar of concentration 6.84, 7.70, 8.55, 9.40 per cent., the readings were 56, 53, 51, and 49 respectively. The isosmotic solution, therefore, has a concentration between 7.70 and 8.55 per cent., viz., about 8.13 per cent., or contains about 0.24 gram-molecules per litre.

In applying this method, it must be borne in mind that it cannot be employed for determining the osmotic pressure of a solution when the dissolved substance can pass through the corpuscle wall. Thus, for example, urea can pass through the wall of red blood corpuscles, and addition of urea to a salt solution which is isotonic with the corpuscles causes no alteration in the volume of the blood corpuscles. The blood corpuscles are also permeable for alcohols, free acids, and alkalis, as well as for ammonium salts; but are impermeable for the sugars, such as cane sugar, milk sugar, and grape sugar.

Osmotic Pressure of Blood.—Since the most important body fluid of animals is blood, many experiments have been carried out on the osmotic pressure of this fluid. The osmotic pressure is most simply and easily determined by the cryoscopic method; and the method is rendered all the more simple on account of the fact that it makes practically no difference whether the experiments are carried out with blood as a whole—that is, including the corpuscles—or with blood plasma or serum. The corpuscles are suspensions, and do not affect the freezing point; and the presence of more or less albuminoid material is also of no practical importance, as we learned in our previous lecture.

On investigating the freezing point of the blood of different animals, it was found that the osmotic pressure of the blood is nearly the same in all cases. This is shown by the following table (Hamburger) :—

TABLE 4.

Blood of	Freezing point.	Blood of	Freezing point.
Man ...	—0.56°	Dog ...	—0.599°
Horse ...	—0.580°	Rabbit...	—0.578°
Ox ...	—0.601°	Cat ...	—0.615°
Pig ...	—0.625°		

In all cases, therefore, with only slight variations, the freezing point of mammalian blood is about —0.6°, corresponding with an osmotic pressure of about 7 atmospheres.

Since the molar concentration of dissolved substance in the blood is subject to very great changes, owing to the introduction into it of varying quantities of dissolved salts and other substances, after partaking of food (and subject also to dilution after partaking of liquids), it might be asked, How does the osmotic pressure vary at different periods of the day? The following table gives particulars of two experiments on this point :—

TABLE 5.

	Freezing point of blood.		Freezing point of blood.
9 a.m.	—0.535°	9 a.m.	—0.512°
12 noon	—0.558°	11-15 a.m. ...	—0.551°
1-30 p.m. (after meal)	—0.585°	2 p.m. (after meal)	—0.617°
5-45 p.m. ...	—0.528°		

The osmotic pressure reaches a maximum shortly after partaking of the mid-day meal, due probably to the salt in the food. But although variations in the osmotic pressure do occur, these variations are, after all, only slight; so that the tissues are always surrounded by a liquid of almost constant osmotic pressure—a condition which is necessary for the healthy functioning of the cells and organs.

This regulation of the osmotic pressure of the blood is, of course, effected chiefly by the action of the kidneys, which excrete more or less concentrated urine according to the

osmotic pressure of the blood. Hence, although the osmotic pressure of the blood remains nearly constant, that of the urine varies very greatly, say from 12 to 26 atmospheres, in twenty-four hours.

Since the regulation of the osmotic pressure of the blood is dependent on the healthy action of the kidneys, marked changes in the osmotic pressure of the blood will indicate impaired activity of the kidneys; and the determination of the osmotic pressure of the blood (by the cryoscopic method) has been proposed for the diagnosis of impaired function of one or both kidneys. Von Koranyi, who was the first to draw attention to this fact, showed that if only one kidney is affected, the osmotic pressure of the blood deviates but little from the normal; while, if both kidneys are impaired in function, the osmotic pressure may rise sometimes to 12.6 atmospheres, or the freezing point may change from —0.56° to —1.04°.

Another interesting observation which has been made with regard to the osmotic pressure of the blood is one which may be of considerable importance in medical jurisprudence. Although, in ordinary circumstances, no considerable difference between the osmotic pressure of arterial and venous blood is observed, it was found by Carrara that in cases of drowning the blood of the left heart shows a much smaller depression than that of the right. Thus, in the case of a dog the blood from the carotid showed a freezing point of —0.60°, whereas, after drowning in fresh water, the corresponding blood from the left heart had the freezing point —0.29°, and that from the right heart —0.42°. If the animal was killed first, and then immersed in water for seventy-two hours, no marked difference in the freezing point of the blood was observed. One should therefore be able to say whether death was due to drowning or had taken place before the body came into the water.

It was further found by Carrara that if drowning occurred in sea-water, and not in fresh water, the relations were exactly the opposite; that is, the blood from the right heart has a smaller osmotic pressure than that from the left. In

the case of a dog drowned in sea-water, the freezing point of the blood from the right half of the heart was —1.01°, and that from the left heart, —1.23°. This was confirmed in a case of accidental drowning of a man in sea-water. The blood from the right heart had the freezing point, —1.04°; that from the left, —1.18°. Such investigations of the osmotic pressure of the blood might be used for deciding whether drowning occurred in fresh or in sea-water. It must, however, be said that very few investigations appear to have been carried out in this direction; but the matter seems to be of sufficient importance to warrant its mention, and also its further investigation.

Before passing from the consideration of the osmotic pressure of the blood, mention may be made of the necessity of taking account of the osmotic pressure in preparing physiologically inactive solutions—physiological salt solution or saline. The physiological saline usually employed has a strength of about 0.7 per cent. This corresponds with an osmotic pressure of about four atmospheres. While this solution is isosmotic with the blood of the frog, and can therefore be used in preserving the tissues of that animal, it is hypo-osmotic to blood of mammals, and would therefore not be so suitable for preserving the organs of mammals, or for injection to replace loss of blood. The physiological saline for mammals should contain about 1 per cent. of salt (sodium chloride), corresponding with an osmotic pressure of about seven atmospheres.

With regard also to the fixing of animal structures, it does not follow that a solution which is isosmotic with the animal juices will cause no change in the volume of the structure, because of the permeability of the cell walls to certain substances. Thus, solutions containing formaldehyde, which are commonly used for fixing animal tissues, cause increase of volume. This is due in part to the presence of formic acid, to which the cell walls are permeable, and can be diminished by neutralisation. Even when that is done, however, a slight increase of volume may be observed, possibly on account of changes produced in the protoplasmic substance.

Osmotic Pressure and Chemotaxis.—I should now like to say a few words with regard to the relation between osmotic pressure and chemotaxis, and the first case we shall take is that of the effect of osmotic pressure in the production of artificial parthenogenesis.

The first experiments in this direction were carried out by Loeb with the eggs of echinoderms. In ordinary sea-water, these eggs, if not fertilised, decay; but if the osmotic pressure of the sea-water is increased by 30 to 60 per cent., most, though not all, undergo parthenogenic development to a free swimming larva. In these experiments it seemed to be of no consequence what substances were employed in order to increase the osmotic pressure, and development would seem to be due to the stimulation caused by loss of water by the ovum.

While it was found that in the case of some of the echinoderms, especially sea-urchins, parthenogenic development occurred by raising the osmotic pressure of the medium, it was found that in other cases, *e.g.*, in the case of the chaetopterus, that when unfertilised ova are placed in sea-water to which a small quantity of a potassium salt has been added, the ova develop to apparently normal larvæ. Such a solution may have an osmotic pressure scarcely higher than that of sea-water, and has no effect on the eggs of the sea-urchin. Further, the effect in the case of chaetopterus can be produced only by potassium salts; other salts do not act. Similar parthenogenic development could be produced in the case of the ova of other animals, but it was found that different kinds require different salts. Thus, in the case of the star fish, parthenogenic development could not be produced by potassium salts, but could be effected by acids. In the case of amphitrite, development can be produced by adding calcium salts to sea-water; but the salts of magnesium, strontium, lithium, potassium, or sodium have no effect. We shall refer to this again later.

Interesting as these experiments are in the study of embryology, no satisfactory theory of the action of the salts has been given, nor have they so far given an interpretation of the natural process of fertilisation.

Other chemotactic influences of the osmotic pressure have also been found in the case of bacteria. The mobility of bacteria in salt solutions of varying concentration was studied especially by Mascart. A small quantity of bacteria culture was placed on a cover glass, which was then inverted so as to give a hanging drop, and placed under a microscope on a small frame of cardboard. Solutions of varying concentration were placed in capillary tubes, and a small quantity of potassium carbonate added to each. The ends of the capillary tubes were then brought into the drop of culture. When the capillary contained only potassium carbonate, the bacteria flocked into the capillary; but as the concentration of the other salts in solution was increased, the number of bacteria which entered diminished more and more; and if the concentration increased above a certain amount, the bacteria were even repelled. (Bacteria employed: spirillum undula, and bacillus megatherium.) On investigating the osmotic pressure of the solutions, Mascart found that equimolecular solutions (isosmotic) had all the same effect. Thus, solutions containing 0.004 mole of salt in 100 cc. of solution allowed the bacteria to enter; if the strength rose to 0.005—0.006 mole per 100 cc., the bacteria remained at the mouth of the tube, and if increased above this the bacteria were repelled. That is, a solution of sodium chloride containing 0.007 mole $= 0.007 \times 58.5$ gm. $= 0.41$ per cent. of sodium chloride, repelled. The action depends, then, only on the osmotic pressure of the salt solution. Bacteria are, however, not all equally sensitive to changes in concentration, and they also possess a certain power of adaptation. If cultivated in a medium containing small quantities of a salt, they become less sensitive to that salt, so that larger concentrations are required in order to repel them.

One further point may be referred to before leaving the subject of osmotic pressure and its action, viz., the poisonous action of pure water. If tissues or cells are placed in distilled water, passage of water into the cells occurs owing to the difference of osmotic pressure. The cells swell up and may finally burst and die. In this way pure water

will act as a protoplasmic poison. A similar poisonous action on cells is observed when distilled water is drunk. In this case the surface layers of the epithelium of the stomach undergo considerable swelling; salts also may pass out, and the cells die and be cast off. This may lead to catarrh of the stomach. It is to this action of pure water that the harmful effect of melted snow or ice is due, since freezing purifies the water. For this reason, also, one of the springs at Gastein has come to be known as the Poison spring, although its water is purer than ordinary distilled water.

(To be continued.)

RHEUMATOID ARTHRITIS AND RAYNAUD'S DISEASE.

By R. LLEWELLYN JONES, M.B. (Lond.), *late Resident Medical Officer, Royal Mineral Water Hospital, Bath.*

THERE would appear to be some obscure pathological relationship existing between Raynaud's disease and rheumatoid arthritis. This hypothesis is strongly supported from the clinical side by the frequency with which these two diseases are seen to exist side by side in one and the same patient. This overlapping of these two conditions has now been attested by many independent observers.

Some years ago, in order to ascertain whether the vasomotor phenomena met with in association with rheumatoid arthritis were identical with, or at any rate indistinguishable clinically from, those avowedly of the type described by Raynaud, I sought for the rarer manifestations of Raynaud's disease. In an article published in the *Edinburgh Medical Journal*, I embodied the results of this search.

Raynaud himself had pointed out that either coincidently or alternately with asphyxial conditions in the extremities, transient obscurations of vision occurred. Galezowski confirmed him, and other observers noted "temporary alterations in the fundus oculi." I had often noted that rheumatoid patients complained of transient obscurations of vision, and accordingly, in company with Mr. Beaumont, of the Bath Eye Infirmary, I took the fields of vision of fifty who suffered with attacks of local syncope or asphyxia in the extremities. The fields in all were concentrically contracted. I did not obtain it in cases where the local asphyxia and syncope were not marked.

An endeavour was made to confirm the vasomotor origin of these phenomena by taking the fields of vision before and after the inhalation of nitrite of amyl. It was noted that some enlargement of the field occurred after the inhalation, but such expansion was found to be fleeting, and, moreover,

the fields of vision of the same patients when taken some weeks after preserved their original characteristics as regards extent. The outline of the fields was remarkable for extreme regularity of contour—no marked disparity of either halves.

During one attack, Mr. Beaumont and myself were fortunate enough to be able to observe the remarkable alterations in the retinal vessels, as pointed out by Galezowski. Mr. Lodge, of Bradford, had noted the constriction of visual fields in cases of Raynaud's disease, and the fact that such a constriction is also found in cases of rheumatoid arthritis is, I venture to think, a point in favour of the clinical identity of the vasomotor phenomena in both diseases.

Again, hæmoglobinuria has been found with suggestive frequency in association with Raynaud's disease. In a case of rheumatoid arthritis which I reported some time since, where the penis and scrotum were the seat of severe paroxysms of local asphyxia, the spectrum of oxyhæmoglobin was found in the urine. I believe that such cases are, although rare, more common than might be expected.

Again, although the more severe manifestations of Raynaud's disease are very rare in rheumatoid arthritis, still, I have seen symmetrical gangrene. In the case of a young girl it invaded both legs, spreading up along the outer side of the legs. It was preceded by extreme pain over the affected areas. The ears may undergo loss of tissue, and the tips of fingers, and the nails are frequently shed.

Macalister, of Liverpool, believes that in Raynaud's disease and rheumatoid arthritis there are common factors at work, and cites cases in support of his contention. He believes that "Acute local necrosis with deep ulceration constitutes a very serious complication in cases of rheumatoid arthritis." In his experience they almost invariably lead to general septic infection and speedy death. In the first case ulceration occurred on the inner side of the knee and perforated the joint. In three cases they appeared on the dorsum of the foot, and in one of these the limb became gangrenous, and even amputation failed to avert death.

Dr. Douglas Stanley has recently reported a case of Raynaud's disease in a child followed by rheumatoid joints, and he drew attention to a possible relationship between the two diseases. This case illustrates one important clinical fact, namely, the Raynaud-like paroxysms preceded the development of joint swellings. This clinical fact cannot, I am sure, be too strongly emphasised. Early diagnosis is of prime importance in all diseases, and it is especially so in a condition like rheumatoid arthritis, which, once well established, is so difficult of amelioration and so defiant of cure; and as a result of observation of some hundreds of cases, I am firmly convinced that these so-called "dead" fingers are very common prodromal symptoms of rheumatoid arthritis. They may pre-exist for years, months, or weeks; they may be slight or severe, but any notable increase in their frequency or severity should arouse suspicion. What relationship they may bear to the subsequent peri-articular swellings it is impossible to say, but the fact remains that the subjects of these local syncopes and asphyxia tend to develop peri-articular swellings, especially in the presence of some concurrent disorder, such as influenza, gastric disturbances, puerperal conditions, etc.

It is, of course, a well-ascertained fact that joint swellings have been noted in the course of Raynaud's disease. Raynaud himself cites cases, which he frankly ascribed to some derangement of the hypothetical joint centres in the spinal cord, thus bringing them into line with his central theory of the mode of production of the symptoms. Weiss, Southey, and others have also narrated cases of a similar nature.

Seeing, therefore, that these two diseases show a tendency to peri-articular swellings supervening upon vasomotor phenomena, the probability of their being closely related pathologically seems a reasonable hypothesis.

The following cases are types of what one very commonly meets with in rheumatoid cases :—

Case I.—H.D.— female, about twenty years of age, unmarried, admitted as a patient into the Mineral Water Hospital, suffering with typical spindle-joint swellings. Her

illness had begun a few months previously. The first symptom she noticed was a "tingling" sensation over the middle of the forearm, both anterior and posteriorly; this tingling terminated at the tips of the ring and middle fingers of same hand. During this time the fingers turned "dead white." The attacks lasted some fifteen to twenty minutes, and were especially severe at night, keeping her awake. Coincidently these fingers were flexed with a "cramp"-like sensation. Three weeks after these paroxysms started, small nodules formed in the flexor and extensor tendons, and previously to this the mid-phalangeal joints of the middle and ring fingers became spindle-shaped, and afterwards the knuckles of same fingers. The same sequence of events took place in the opposite hand, namely, middle and ring fingers. About three weeks afterwards fusiform swellings appeared in the index and thumb. As regards her previous history, it was noted that the above symptoms began in January, and in the second week of the previous month she suffered with a sore throat for some days.

Case II.—A.P., female, aged fifty-two years, married, had fourteen children. Since her last confinement, when she suffered with "white leg," has always been delicate. She, however, never suffered with anything definite until last Good Friday, when the fingers of her left hand went "perished" very blue, with "tingling"; the ring and middle fingers were most severely affected. The attacks recurred several times a day, and the mid-phalangeal joints of those fingers became swollen. In less than a fortnight typical spindle joints were present; the same sequence was observed in the opposite hand. Symptoms of a like asphyxial nature appeared in the feet, and the ankles swelled almost directly; the knees followed suit. Her left tempero-maxillary joints became affected, and she suffered with obscurations of vision, and used to ask patients if there was a "fog" in the room. She suffered at this time with recurrent attacks of "chilliness" in the loins, attended by strangury, at which times her urine used to go very dark, changing its colour rapidly during a few hours. I was, unfortunately, never able to obtain her

urine for examination after one of these attacks. The next symptom she had brought to her notice by her children, who complained that she used to " stare " at them, and gradually her eyes grew more prominent. This protrusion was more marked in the case of the left eye, which presented the following characteristics: proptosis, Von Graefe's sign, with an intermittent Stellwag's sign, some paresis of the internal rectus. The right eye showed these symptoms to a lesser degree. She had noticed her collars growing tighter; her thyroid was enlarged, but varied greatly in size. Her pulse was 92. Fine tremor was present.

Case III.—E.C., female, aged thirty-six years, single. Personal history: Had suffered from symptoms pointing to gastric ulcer for some years; had hæmorrhage from stomach on several occasions. During all these years she had suffered with " pins and needles " and recurring syncopal attacks in fingers. The last hæmorrhage from the stomach occurred a month previously to onset of joint swellings, and in the intervening month a great increase in the severity and frequency of the syncopal seizures was noted. Accompanying these symptoms were severe muscular cramps.

Space precludes my quoting any more cases in detail. Recently I reported some cases of rheumatoid arthritis following on gastro-intestinal disorders, gastric ulcer, chronic dyspepsia, chronic diarrhœa.

Arbuthnot Lane, in discussing the evils that may accrue from chronic constipation, lays stress on the dangers that attend the absorption of toxins from the intestinal canal, and states that " later in life, tubercle gout, gastric ulcer, rheumatoid arthritis, and many other similar diseases attack this class of patient with what might almost be called selective action." In the cases I reported, all of them had suffered with local syncopes and asphyxias, and that they were in some way related to the concurrent gastric disorders was indicated by the fact that any remission or exacerbation in the latter condition was correlated with a similar decrease or increase in the severity of the vasomotor phenomena.

This relationship of rheumatoid arthritis to gastro-intestinal disorders is of much interest when we remember that peri-articular swellings may occur in another disease dependent upon gastro-intestinal toxæmia, namely, tetany; and likewise the so-called "dead fingers" occur in pernicious anæmia, and have been observed to ensue during the course of chronic intestinal obstruction.

Such vasomotor phenomena may occur also in cases of rheumatoid associated with uterine disorders. To-day I saw a case in a lady, in which the joint affections had followed upon some uterine disorder for which curettage had been deemed necessary. In another lady—the subject of severe constipation from childhood—the Raynaud phenomena had been present for many years, and seem to bear a direct relationship to the bowel condition, inasmuch as treatment directed to the latter benefited the former. Latterly effusion into the joints had occurred, and scleroderma of a severe form had developed in the areas where the asphyxial seizures were most pronounced.

Scleroderma has been noted by several observers in Raynaud's disease, and by others in rheumatoid arthritis. Some have claimed that Raynaud's disease may pass into a condition of scleroderma.

In one of the cases quoted it will have been noted that the symptom-complex Graves' disease was engrafted upon the rheumatoid condition. Such an association is by no means uncommon. I have reported twenty cases; Solis Cohen has reported one. In a recent report of the Buxton Hospital, three cases of these two diseases occurring in association have been noted. Macalister believes that there is some bond between these two diseases, and believes that the connecting link is found in the Raynaud-like conditions which are met with in both conditions.

In my series of cases the following sequences were observed:—In some the Graves' symptoms were engrafted on a pre-existing rheumatoid condition; in others, both diseases seem to arise contemporaneously; and in others, rheumatoid disease was implanted upon a previously existing Graves'

disease. This association led me to try the effects of thyroid medication in some cases. Macalister, independently of myself, had also been led to the same therapeutic method. He cites most interesting cases, and in two of them a cure was effected. My own experience was a mixed one. In same cases, preferably those characterised by much œdema, marked benefit was quickly attained; but in others the results were disappointing, and the drug had to be relinquished owing to the troublesome tachycardia induced. This capriciousness is exactly the counterpart of what occurs in the treatment of Graves' disease by thyroid feeding. In some cases it has proved very successful; in others most disappointing.

Again, in some cases of Raynaud's disease, thyroid medication has proved useful. All these clinical and therapeutic similarities tend to support the view that there is some obscure linkage between these three diseases.

If I may be allowed a digression, I should like to draw attention to another triad of diseases, in which some profound pathological kinship appears probable. Lorand believes such a relationship to exist between acromegaly, Graves' disease, and diabetes.

From the pathological side it is a most interesting fact that each of these three diseases are attended by morbid changes in three ductless glands, *i.e.*, the pituitary, the thyroid, and, in some cases of diabetes, the pancreas. On the clinical side we also find similarities or affinities. In Allbutt's System a case is quoted in which the conditions of Graves' disease, acromegaly, and glycosuria co-existed in one and the same patient. Glycosuria has often been noted in Graves' disease and acromegaly. Without going further into this interesting question, I would only like to point out the possibility that in some cases of, for example, Graves' disease, where treatment by thyroid has failed, a combination of thyroid and pancreatic extracts might prove more successful.

That these internal secretions play an important rôle in the maintenance of stable metabolic equilibrium is obvious, and it is probable that to a certain extent one may take the

place of the other. Note the hypertrophy of the thymus in some cases of Graves' disease. Such persistence of the thymus occurs also in acromegaly, and in this connection one must bear in mind the fact that some cases of Graves' disease have benefited from administration of the thymus gland.

I have gone into this side issue simply because it is just possible that in those cases of rheumatoid disease where thyroid has failed when given alone, it might with advantage be combined with one of the other gland preparations, as, for example, pancreatic extract. I mention the latter because of the intimate association that appears to exist between gastro-intestinal disorders and some cases of rheumatoid arthritis.

As regards the pathology of rheumatoid arthritis and Raynaud's disease, one feature of their pathological life history is, I think, worthy of note, namely, that they seem to have evoluted, so to speak, along the same lines.

Raynaud's disease was held by its discoverer to be a disease of the central nervous system; but with the advent of bacteriology and its attendant toxicology, the tendency has been to consider the morbid central change as secondary to a toxæmia. Very recently an organism was detected in the blood of a case of Raynaud's disease.

In the same way rheumatoid arthritis was deemed by the older writers to be of central nervous origin. Ord believed that the joint swellings and related muscular atrophy were of the nature of a dystrophy, analogous to progressive muscular atrophy. This view gave way to the infective theory of its origin. Here again difficulties appeared. Organisms were not found constantly in the joint fluids, and, moreover, not one organism only, but different organisms, have been found by many observers.

This inconsistency and variety in the bacteriological findings is a strong argument against there being any specific organism, and the sterility of the joints in a far greater number of cases favours the view that such organisms, when present, are of the nature of a secondary infection. As a

result of my own experience, I incline to think that the disease is of the nature of acerebro-spinal toxæmia derived from many sources.

There are, of course, difficulties in the way of such a theory—notably the question as to the mode of production of the joint swellings. Are they trophic in origin? In tetany —a disease known to be due to a gastro-intestinal toxæmia— such an origin is claimed for the joint swellings that occasionally occur in its course.

If it could be proved that the joint swellings of rheumatoid arthritis were comparable with the spinal arthropathies, then its central origin might be argued with justice; but hitherto the point has not been settled. Controversy still reigns about the old vexed question as to the similarity, if not identity, of the joint changes of the more chronic forms with those of the chronic spinal arthropathies. Again, while such a comparison as this is justifiable in the more chronic forms of rheumatoid joints, it certainly cannot be instituted between the more acute or early stages of rheumatoid arthritis where the changes are confined to the synovial tissues; but it is well to remember that in the so-called more acute forms of spinal arthropathies the changes are confined to the synovial tissues.

The question must be left open at present. One point in favour of its being a cerebro-spinal toxæmia is that the related vasomotor phenomena, the muscular atrophy, the trophic changes, the pigmentation, etc., might on this ground be explicable. As regards actual pathological findings, they are such as might be found in any chronic toxæmia. Posterior sclerosis has been found in rheumatoid and also in pernicious anæmia, diabetes, ergotism—a disease closely allied to tetany.

As regards the association of Graves' disease and rheumatoid arthritis, I would like to draw attention to one of the many features they have in common, *i.e.*, the quick pulse; and, in view of the increasing recognition of the fact that these two diseases may, so to speak, exist in fusion, I would like to suggest that the quickened pulse rate in rheumatoid

arthritis may possibly be a larval manifestation of Graves' disease.

In conclusion, I would like to emphasise the following points :—

1.—That these so-called "dead" fingers, local syncopes, and asphyxias are often precursors or, so to speak, prodromal symptoms of rheumatoid arthritis. They are not invariably present before peri-articular swellings occur, and in some cases they appear to arise contemporaneously with the joint swellings; but the fact still remains that people who suffer with them are likely to develop rheumatoid joints, especially if exposed to any infection—sore throats, influenza, etc.

2.—The diverse ætiology of Raynaud's disease and rheumatoid arthritis teaches us that both these disorders are, as a rule, secondary to some other disorder; in other words, that they are both of them symptoms complex. This supplies us with a therapeutic indication, namely, that in any given case, if such vasomotor phenomena present themselves, a search should be made for some concurrent disorder, and treatment directed thereto.

Unfortunately, in many cases no source of toxæmia can be discovered, but I would emphasise the importance of treating gastro-intestinal disorders and uterine affections. Macalister lays great stress upon affections of the nasal mucous membrane, and cites cases in support.

3.—In cases of rheumatoid arthritis where such prodromal vasomotor phenomena have been absent, others may take their place, such as those pertaining to the muscular sphere —sudden weakness, painful cramps and muscular atrophy; in others, sensory phenomena predominate, namely, definite neuralgic pains or paræsthesiæ.

One important feature of all these prodromata is their tendency to be more marked in those extremities which afterwards become the seat of peri-articular swellings.

Realising the intractable nature of rheumatoid arthritis when well marked, I do not think that one can lay too much stress upon any symptoms, which, though apparently trivial in themselves, may give us timely warning and enable us possibly to avert the development of rheumatoid arthritis.

REVIEWS.

Blessures du Crâne et l'Encephale par Coup de Feu. By H. NIMIER, médecin principal de 1re classe, professeur au Val-de-Grâce. Pp., 624; 158 illustrations. Paris: Felix Alcan. 1904.

M. NIMIER has brought together in this work a great number of observations on firearm wounds of the head and brain, and, in order to make clear the symptoms produced by the injuries, he enters fully into details of the normal anatomy and physiology of the skull and brain. This book is the most complete on the subject that we remember to have met with in any language, and should prove valuable alike to the physician and to the surgeon. To the military surgeon, M. Ninicer's book should prove of the greatest possible value.

Guide Pratique de Chirurgie Infantile. By E. ESTOR, Professeur à la Faculté de Médecin de Montpellier. Pp., 474; 165 illustrations. Paris: Félix Alcan. 1904.

RECOGNISING that the practitioner, though he has had opportunities of making himself conversant with the methods of general surgery, yet frequently meets with difficulties in the diagnosis and treatment of the surgical diseases of children, M. Estor has produced, in the book now under review, what should prove to be a most useful guide for all who have to treat the surgical diseases most commonly occurring in children. The book is meant to be a *vade mecum* for the practitioner rather than a systematic treatise for the operating surgeon. The articles consequently are short and to the point, while the subjects are arranged in alphabetical order. Naturally, the treatment recommended is in many instances not that usually carried out in this country. For instance, the author seems, whenever possible, to advocate subcutaneous rather than open surgery. As examples of this, we

may give the treatment recommended for suppurating tubercular glands and for tubercular abscess of the hip, viz., drawing off the pus and injecting a solution of iodoform in ether. Again, it is recommended that congenital hydrocele should be treated by drawing off part of the fluid and then injecting alcohol, a finger being pressed on the neck of the sac, so as to prevent the alcohol flowing into the peritoneal cavity. Though in England we should probably not agree with all that M. Estor recommends, yet it should be borne in mind that it is always interesting and instructive to become acquainted with the surgical practice of other countries. We can most cordially recommend M. Estor's book.

Landmarks and Surface Markings of the Human Body. By Louis Bathe Rawling, M.B., B.C. (Cantab.), F.R.C.S. (Eng.). London: H. K. Lewis. 1904.

In this little volume of seventy pages, the subject of surface marking is presented in an exceptionally clear and readable style. The author has been able to compress much information into a small space by avoiding unnecessary details, and by the help of some excellent illustrations. There are twenty-nine plates, including half-tone and coloured, and the text is practically a detailed description of these, as each paragraph has a side-note which refers the reader to the corresponding figure. There is, however, no suggestion of the catalogue about the book, and we have found the subject matter both interesting and edifying. The author's style is, on the whole, remarkably lucid, but the following sentence, describing the left and lower point for mapping out the heart, is lax and requires revision: "The fifth left interspace one and a half inches below and just internal to a line drawn vertically downwards from the nipple." There is a useful appendix giving measurements and weights of most of the organs in the body. The book is just what has long been wanted by the senior student and practitioner, and we heartily recommend it as a handy and reliable guide on the subject.

Tuberculosis and Acute Miliary Tuberculosis. Northnagel's Practice. London: W. B. Saunders and Co. 1904.

In reviewing the volume on "Diseases of the Lungs" of this publication, we pointed out that Tuberculosis had been omitted. The reason for this was that the whole subject of tuberculous disease—its pathology and morbid anatomy, as it occurs in the lungs and in the acute miliary form—was to be treated in a separate volume. We are convinced of the wisdom of this plan, for tuberculous disease has come into great prominence of late, and our conception of it to-day is so much wider than it was but a short time ago, when the pulmonary manifestations under the title of "consumption" were the leading view.

The volume on Tuberculosis is divided into three parts. The first treats of the history of the tuberculous process, histology, and modes of invasion of the tubercle bacillus. There are also chapters on Infection, Heredity, and Predisposition. Of this portion of the book there is not much that calls for special notice, for the matter treated is entirely general, and as such is very carefully presented. Chapter V., on Infection, is doubtless the most interesting, as indicating those sources of tuberculosis which modern pathology has investigated with such care. The contamination of the air by sputum, the cleaning of rooms containing germ-laden dust, "family" and marriage infection, are all fully discussed. The liability of those who, like nurses and physicians, have to come in contact with tuberculous patients, seems to be settled in the affirmative.

Concerning the identity of bovine and human tubercle, it is stated (p. 18) that the bacilli of human and bovine tuberculosis are the same organism, but modified in their activity by change of host. By transmission through cattle they acquire increased virulence for cattle, but lessened virulence for man. It is interesting that in an editorial note it is stated that primary tuberculosis of the alimentary tract in infants is acquired from the milk of tuberculous cows, "but it must be remembered that primary intestinal tuberculosis is a very rare condition." We believe this statement

is open to criticism, for, now that cases are being looked for, it will probably be found that primary alimentary tubercle is much commoner than has been taught. In Birmingham we have noticed several, relatively speaking, during the last eighteen months.

Part II., Pulmonary Tuberculosis.—This division of the work opens with an account of the morbid anatomy. We may say at once that it does not appear to us sufficiently elaborated. The chapter makes, in our opinion, too little of the varieties of pulmonary tuberculosis. Notwithstanding the modern tendency to emphasise the "unity" of the tuberculous process, as Baumgarten and others maintain, it is important from a clinical standpoint to recognise that this process may and does affect the lung differently, producing on the one hand acute pneumonic phthisis, on the other miliary tubercles, and as a result very different clinical signs—signs that mean much in diagnosis and prognosis. For a work of this magnitude, we must say that the chapter on Pathological Anatomy is short out of proportion.

The greater portion of Part II. is descriptive of the clinical history of pulmonary tuberculosis. It is very complete, especially in the account of the condition of the organs and tissues other than the lungs. In particular, the "hæmatology of tuberculosis" is worthy of mention. Tachycardia, as a symptom of tubercle, is interesting, but difficult to explain. Vagus compression, diminution of the calibre of the air passages, vagus neuritis are among some of the theories advanced by various authors, and discussed by the writer of this monograph.

The chapter on Treatment is eminently satisfactory, as it is full of practical details for dealing with special symptoms. Especially full is the portion relating to health resorts and the climatic treatment of phthisis: the only drawback for English readers is that no mention is made of places in the United Kingdom where tuberculous patients may be sent. At first sight, it might appear that our insular climate, with its samples of weather, is not worth mentioning, but there are many English localities that are much

more genial than some North Sea places which come in for a mention by the learned writer. The author is strongly of opinion that sea voyages are dangerous for consumptive patients. Needless to say, the open-air method of treating receives full justice.

Part III.—Acute General Miliary Tuberculosis.—As the title implies, this part of the book deals with the miliary tubercules, and the forms described are the typhoidal, the pulmonary, and the meningeal.

There can be no doubt that the volume on Tuberculosis in Northnagel's Practice is a monograph of great importance, representing the present state of our knowledge of one of the most widespread and fatal diseases that we have to treat. The value of the book is increased by the bibliography, which occupies ninety pages, and being classified for reference will prove of great use to the reader.

A Treatise on Applied Anatomy. By E. H. TAYLOR, M.D., F.R.C.S.I., Surgeon to Sir Patrick Dun's Hospital; University Examiner in Anatomy, and late Lecturer in Applied Anatomy, Trinity College, Dublin; etc. Pp. 704; illustrated with 178 figures and plates, from original drawings, many printed in colours. Charles Griffin and Co., London. First edition. 1904.

WE have read this book with much pleasure and satisfaction. It is intended, the author states, to bridge over the gap between the dissecting room and the operating theatre by showing the practical application of the dry facts of anatomy to medicine and surgery. It presents in terse and compact form, descriptions of the anatomical structures involved in certain medical and surgical affections, and in the operative procedures, often elaborate and prolonged dissections, required for their relief. It is founded on a course of lectures delivered under the direction of Professor Cunningham at Trinity College, Dublin. We should like to see such a course of lectures given in every medical school as a compulsory portion of the curriculum, and students encouraged to continue to attend it throughout their career.

We might cavil at the title of the work, but the author admits that "Surgery from the Anatomical Standpoint" would, in some respects, more correctly designate its scope. Although the anatomical matter presented is excellent in its selection and accurate in its description, yet it is brief. In a work on Applied Anatomy we might reasonably expect the anatomy to be given the first place, and not assigned to a secondary position—and small type—as in this instance.

In the plan followed in the book, the description of each region begins with an account of the anatomy—and development when required—and proceeds to the practical application of these points to the more common medical and surgical affections which may occur there.

The contents are divided conveniently into sections: The Head and Neck, Upper Extremity, Thorax, Abdomen and Lower Extremity. The illustrations are very clear and commendable; the majority of them are from drawings by Dr. J. T. Murray, of Edinburgh.

We find the description of the Cranium and Brain, and especially of cerebral localisation, particularly good: such recent work as that of Sherrington and Grünbaum on the cortical areas is included. The illustrations of the adbominal viscera are very realistic: the formalin method of hardening tissues *in situ* has been utilised to this end with very happy results.

On page 672 the word "outer" should be "inner": this is the only *erratum* we have noticed. The book is a worthy example of the well-known series from this publishing company. We find it difficult to "place" this work: the student's library must perforce be restricted to and contain only such books as are strictly necessary, and this *Treatise on Applied Anatomy* does not come into this category. There is no student, however, who would not be the better equipped mentally by having been brought up on it. As a work of reference, to those preparing for the higher examinations in surgery, to the operating surgeon, but above all to the "Surgical Tutor," it will prove invaluable. We heartily congratulate Dr. Taylor on the success with which he has achieved his object in the compilation of this book.

Studies in Heterogenesis. By H. CHARLTON BASTIAN, M.A., M.D., F.R.S. Pages, 352; plates, 19. Published by Williams and Norgate. Price, 31s. 6d.

WITH this large and handsome volume, Dr. Bastian, after many years spent, in a brilliant fashion, teaching and practising his profession, resumes his study of the fascinating subject of the origin of the lowest organisms. The storm of criticism which his former contributions evoked has swept over him, leaving him unbowed, for we still find the same arguments, heresies, and rash conclusions.

Heterogenesis he defines as the production from the substance of organisms or their germs of alien forms of life. All evolutionists will admit that such heterogenesis takes place, the change being probably slowly accomplished, and for a definite purpose—an intelligent reaction of the organism to its environment. For Dr. Bastian, however, it means that it is a commonplace of life for ciliated infusoria in a few days to arise from encysted euglenæ or the eggs of hydatina, and amœbæ to spring from the dying cells of a conferva. Startling as such statements are, it is even more surprising that the evidence for them vouchsafed should be seriously considered to have any weight. On page 10 we are treated to a description of the heterogenesis of the amœba. He takes a small conferva from a ditch, washes it under a fine spray of water to get rid of the mud intermixed with it, but makes no other effort to isolate it from other low forms of life. He next exposes it in a shallow dish to the sunlight. Three days later the conferva was dying, and in the filaments the cell contents had separated from the cell-wall, and had assumed a more or less spherical form. The contents of the cells formed later granular amœboid masses. The next observation is that two cells in the centre are empty "owing to the amœbæ having made their way out." He then concludes, "Here we have in the most obvious manner the whole endochrome of each confervoid cell individualising itself, becoming decolourised and transformed into a single amœba." It will be noted that the specimen was not carefully isolated, no examination was made of the water, no

control experiment, no methods adopted to avoid infection, no statement of having seen the amœbæ—the whole observation based on two empty cells in a filament! And yet Dr. Bastian has the effrontery to say that if any adopt the hypothesis of infection in explanation the burden of proof must lie with them.

Although the book appeals chiefly to micro-biologists and evolutionists, the last chapter of the book is intended for medical readers. We are glad to say further that it is written in a very interesting and suggestive manner. He here deals in an argumentative manner with the observations and statements of others, and here he shows to marked advantage. His remarks on Duvaine's and Pasteur's septicæmia, on Burdon Sanderson's classical production of the latter disease by injection of germ-free chemical irritants, are excellent and to the point. His views on the relation of Eberth's bacillus to the bacillus coli communis, and on the indefinite nature of the line between diphtheria, scarlet fever, and tonsillitis appeal to us as sound and likely to be accepted in the future. He is perhaps less happy in his remarks on phthisis. In conclusion, we can commend the last chapter to the attention of all students of medicine.

Membranous Catarrh of the Intestines. By CARL VON NOORDEN. Bristol: John Wright and Co.

THIS is one of von Noorden's clinical treatises on disorders of metabolism and nutrition, subjects with which the author's name has become associated. Membranous catarrh, according to the author, occurs almost exclusively in subjects who have suffered for a long time from constipation. There is over-activity of the muciparous glands of the large intestine, due, not to anatomic changes, but to certain nervous influences. In the writer's opinion, the disease occurs almost exclusively in persons who have a neurasthenic or an hysteric predisposition. "The best method of treatment is the dietetic exercise treatment," in contra-distinction to the protective treatment that is usually

employed. By this the author means that sufferers from colica mucosa should have a diet that is very coarse, containing a large proportion of indigestible residues. Massage of the large intestine, particularly of the sigmoid flexion, is a most important adjuvant to the treatment. While admitting that massage in cases of spastic forms of constipation is of doubtful efficacy, von Noorden is convinced that massage with a voluminous diet is not attended by any discomfort, and is in reality the proper method of dealing with colica mucosa. What the author emphasises is that unless constipation be overcome, it is useless to expect any improvement in these cases.

The well-known reputation of the author necessarily commands attention to his views. At the same time, there are probably cases which it is essential to differentiate, as they do not improve when put on any but a very bland and unirritating diet. The book is suggestive and well worth careful consideration. We are indebted to Dr. Boardman Reed, of Philadelphia, for the translation.

REPORTS OF CASES.

A CASE OF TUMOUR IN THE THIRD VENTRICLE.

By O. J. KAUFFMANN, M.D.

J. R., aged forty years, was admitted into the Infirmary on September 24, 1904. He was comatose, and breathing deeply and stertorously, but could draw up his arms and legs in response to peripheral stimulation. The left side of the face appeared rather flatter than the right, and it was thought that there was slight weakness of the left eyelids. Temperature, 101°; pulse, 88; respiration, 28. The condition remained practicallly unchanged for twelve hours, until about 8 a.m. next morning, September 25th. In that period he had several times passed urine and fæces in bed. The temperature had gradually fallen to normal. At the hour named, consciousness began slowly to return, and by noon he had recovered sufficiently to make rational replies to questions of a simple nature, though he had still much confusion of thought, was inclined to yawn, and, if left undisturbed, quickly dropped off into quiet, natural sleep. He had no recollection of the seizure on the previous day, nor of having been brought to the Infirmary. Temperature, 98°; pulse, 72; respiration, 24. Urine normal. Knee-jerks equal and moderate; plantar reflexes equal in extent and rapidity, and both flexor. No trace of hemiparesis, hemianæsthesia, or hemianopia, and no speech-defect. The tongue was protruded mesially, and there was no trace of facial weakness, either during rest or on exertion of the muscles. The patient was completely blind in each eye from early infancy, the corneæ showing many opacities, rendering the pupils difficult of definition; they were, however, equal and rather small.

The history was as follows:—For twelve months before the apoplectic seizure above detailed, the patient had been continuously an inmate of the workhouse. Apparently there

had been no reason to suspect any grave illness until September 24, the day of his admission into the Infirmary. On that day he was noticed to vomit several times, but did not keep his bed. About 9 p.m. he was found unconscious and stertorous, and was transported to the Infirmary.

On September 30, the patient having apparently regained his usual health, he was allowed to get up, and found his way about in his accustomed manner. Four days later, looking and feeling quite well, and presenting no vestige of paralysis, he was sent back to the workhouse. No definite diagnosis as to the cause of the apoplectic attack was made.

On October 25, twenty-one days after his discharge, he was re-admitted in a semi-conscious state, and unable to reply to questions. He resisted handling, and the conjunctival reflexes were present. He vomited once, and threw his arms about restlessly. At 10.30 p.m. the coma had deepened, the face was flushed, and respiration stertorous; the temperature had risen to 104.6°. Both plantar reflexes were brisk and extensor. An hour later he died.

It may be inferred that for about twelve months before his first admission the patient had enjoyed apparent good health. It is almost certain that during that period he had not suffered from vomiting or severe headache, for it is customary to transfer persons thus affected to the Infirmary without delay. The fundi of the eyes could not be examined owing to the corneal opacities.

Post-mortem Examination.—The body was remarkably well built and proportioned, and well nourished. The scalp rather hyperæmic, and the bones of the skull thicker than normal. The dura adhered extensively and strongly to the calvarium. The pia mater looked abnormally dry on the surface, and felt tacky, not smooth like the normal pia. The cerebral gyri were much flattened and the sulci narrowed, as from considerable intra-cerebral pressure. On cutting the infundibulum in removing the brain, a large gush of cerebral fluid occurred. Apart from the compression, the surface of the brain was healthy, and there was no meningitis. The optic nerves, tracts, and chiasma were very thin, and of yellowish colour (see note on the blindness).

Description of the Tumour.—The tumour, as large as a small hen's egg, roughly resembling the same in shape, and measuring two inches in length by one and a half inches in

PHOTOGRAPH, SHOWING THE POSITION OF TUMOUR.

greatest breadth, occupied the greater part of the third ventricle, the cavity of which was considerably dilated by the growth. It had apparently originated in the choroid plexus

of the third ventricle, and was completely encapsuled in the layers of the velum interpositum, which membrane appeared a little thin where it was stretched over the tumour, but showed no other morbid change. The choroid plexuses of the lateral ventricles were healthy. The veins of Galen were easily traced over the hinder part of the upper surface of the growth. Superficially to this ran the body of the fornix, much thinned, expanded, and softened by pressure. Pretty free rocking movement could be imparted to the tumour with its capsule, and it was held in position by this alone, being unconnected with any part of the brain-structure. By gently shifting the growth, the three commissures could be seen, intact as to continuity, though lengthened by recession of the corpora striata and thalami. Behind the posterior pole of the tumour, the commissura habenularum appeared, looking quite normal. The pineal body had become adherent to the lower fold of the velum encapsulating the tumour. On cutting the velum laterally on each side, it became easy to turn back the tumour, thus exposing the widened cavity of the third ventricle and infundibulum, and the flattened opposed surface of the basal ganglia. The pulvinar in each side was somewhat small and shrivelled—a condition associated, in all probability, rather with the atrophy of the optic tracts than with the intraventricular pressure. The foramina of Monro were not recognisable.

When the brain was freshly opened, the growth, having its upper part alone exposed, had very much the appearance of a fresh oyster, possessing the same greenish-grey tint, and apparently a very similar consistency. It was, in fact, so soft as to give the impression of a very slack cyst. But after hardening in formalin, it acquired a yellowish-pink colour, and a firmly gelatinous consistency, with a tendency to gape on section. The cut section looked uniformly grey, with the exception of a few opaque white specks, widely scattered.

Microscopic examination was very little successful. Freshly cut frozen sections displayed the structure poorly; and still less was made out from sections cut in paraffin after

hardening in formalin. The growth consisted of small cells, roundish and oval, situated in a matrix, which later formed the greater part of the mass. There was a total absence of blood-vessels; but many lacunæ were distributed through the matrix, looking like lymph channels; their walls showed no special structure, and they gave the impression as having been merely hollowed out of the matrix. The tumour cells were granular, showing no nuclei, stained a diffuse pink with Von Giessen's stain, and showed no systematic grouping. The matrix was, to all appearance, structureless, and took a pale yellowish-pink colour. Several other nuclear stains failed to show nuclei in the cells.

I regard the growth as being a degenerated sarcoma, probably most fittingly to be termed a myxo-sarcoma. For its duration no data are forthcoming, but it is certain that it had grown slowly, judging from the great enlargement of the third ventricle and the absence of symptoms.

ABSTRACTS.

THE PATHOLOGY OF BUBONIC PLAGUE.

THE first to take advantage of the discovery of the plague bacillus by Kitasato and Yersin in 1894 in order to study the pathological anatomy of the disease was a Japanese observer, Aoyama. During the epidemic in Hong-kong in 1894, Aoyama performed post mortems on fifteen cases, and described the pathological conditions found. Since that date numerous works have appeared on the subject, probably the most valuable being "Die Beulenpest in Bombay im Jahre, 1897," by Albrecht and Ghon, in which the results of forty-eight post mortems are fully detailed. A further work of very considerable value has just appeared in the form of a supplement to Ziegler's Beiträge by Professor Dürck, the author of the well-known text-book on pathological histology. The value of this paper is greatly enhanced by the accompanying plates illustrating the naked eye and the microscopical changes in the diseased organs in plague.

The material for the work was obtained from sixteen cases which were personally examined *post mortem* by the author during a stay of two months—February and March, 1901—in Bombay.

As regards the primary site of infection, the author holds the most usually accepted view that it is through some slight skin lesion that infection occurs. In only one of the sixteen cases, however, was there any specific infection of the skin itself, and in that case it was more than probable that the skin condition was secondary. As a rule, therefore, at the time of the *post mortem*, it was impossible to decide as to the point of inoculation, and in only one case was there a history as to the probable cause. In this case it was a rat-bite in the temple which subsequently became the seat of extensive œdema, sloughing, and necrosis of bone. The first obvious primary seat of the disease was invariably in a lymph gland or a group of lymph glands. Attention is, therefore, first of all directed to the pathology of the bubo.

As regards the distribution of the buboes, the inguinal glands of one side only were affected in eight cases; twice the condition was bilateral. In two cases the axillary glands were the primary seat, and the cervical, mandibular, and pectoral each in one case; there was no glandular infection at all in one case. The inguinal glands are, therefore, most frequently affected, and this is readily understood when one remembers that the natives go about bare-footed, and their feet are, in consequence, constantly exposed to the possibility of slight injuries.

The macroscopic appearance of the affected glands varies, according to the duration of the process and its intensity, from a slight swelling of a greyish-red colour to enormous enlargement with hæmorrhage and necrosis. Such a necrotic bubo has an almost caseous appearance. In many cases, owing to pus formation, or, more frequently, to hæmorrhage, the capsule of the gland is burst, and the whole becomes surrounded with pus or blood, instead of œdematous tissue as at first. The appearances somewhat resemble those of the mesenteric glands in typhoid; the similarity is further borne out by the microscopic appearance.

The histological changes in the bubo depend, to a considerable extent, upon the number and virulence of the bacilli which have gained access. The appearances may be divided under the heads of exudate and cells. The exudate is at first serous, and consists of a strongly albuminous fluid which fills the sinuses, and infiltrates the capsule of the gland and the surrounding tissues. This exudate may be recognised in stained specimens as a homogeneous groundwork with vacuoles. It is best seen in the younger buboes forming a network between the cells. The exudate does not, as a rule, give the fibrin reaction, although single small particles may appear light blue. Whenever there is, in addition, destruction of cells, however, a network of fibrin is found distributed through the gland substance, an appearance not uncommon in the typhoid gland. Another very common change is the formation of fibrin within the blood-vessels of the gland, its capsule, and surrounding tissues. In all probability, this widely-distributed thrombosis within the vessels

is, along with the poison of the bacteria, the chief cause of the necrotic changes in the buboes.

Turning to the cellular changes in the affected glands, one finds, especially in the more chronic cases, a very characteristic cell, the "blasenzell." These cells are large, round, and bladder-like, except when flattened from mutual pressure; they are rich in protoplasm which stains well with eosin; their nuclei (there is often more than one) are darkly stained and show a dense network. The protoplasm of these cells is often vacuolated, and may contain masses of detritus, leucocytes, or red blood cells. Sometimes they contain plague bacilli, it may be in very large numbers. As a matter of fact, these are the only cells in which the author has found plague germs; he has not been able to find in one single preparation a plague bacillus inside a leucocyte or connective tissue cell. These cells occur in, and often fill, the sinuses; their origin is uncertain; they may represent, according to the author, the descendants of the large lymphocyte. This seems, however, unlikely, as their protoplasm is, as above described, acidophil.

A second type of cell sometimes present in large numbers is a large polygonal or spindle-like cell with long processes which may be forked, with a pale, round nucleus, fine nuclear network, and small nucleoli. These latter cells, in all probability, originate from the pre-existing endothelial cells of the reticulum, and are probably identical with similar cells found in the spleen. The author considers it possible that these cells may act as phagocytes, but he has never seen plague bacilli within them.

As previously mentioned, pus formation is not uncommon both in and around the buboes. It was long considered that this pus formation was due to the presence of pus-forming organisms such as staphylococci. The author's observations do not bear this out. He considers that the plague bacilli are themselves capable of producing pus. Of course, when the buboes extend towards the surface, they become infected, and extensive ulceration and tissue destruction occur.

The two characteristic changes in the plague bubo, necrosis and hæmorrhage, are regarded by the author as of the nature

of infarction, anæmic and hæmorrhagic, due to blocking of the vessels. The tissue coagulation caused by the loss of blood supply explains the firm caseous appearance of the necrosed areas. The nuclei of the cells in these areas undergo the changes known as karyorrhexis and karyolysis.

Turning to the appearances of the plague bacilli within the lymph gland, one finds, in the first place, that their number is very variable. Some buboes were examined in which not a single bacillus could be found; in many cases, on the other hand, the organisms were present in such enormous numbers that it was possible to see the masses which they formed with the naked eye or with a low power of the microscope. In fact, one may say that there is no pathological condition in which the causal organism is present in such abundance as in the glands in bubonic plague. Where necrosis has advanced far, however, it may be very difficult to demonstrate the organisms. It is in the early condition, where the cells are well preserved and stain deeply, that the bacilli are most easily found. In the necrotic areas the bacilli rapidly lose their staining properties. They become at first thicker, and the middle part of the body of the organism ceases to stain at all, giving the appearance of a diplococcus.

The organs which come second as regards their claim to interest in bubonic plague are the lungs. In a large proportion of the cases investigated these were the seat of pathological changes observable with the unaided eye.

In the first place the smaller air passages were the seat of an acute inflammation. That this is caused in many cases by the plague bacillus itself is proved by the large number of cases in which that organism is found in the sputum. Enormous numbers of the organism may be present both in the sputum and in the air passages when examined *post mortem*. In the latter case one finds them lying in masses between the desquamated epithelial cells and pus corpuscles. From the above facts one readily understands the danger which those who come in contact with plague cases undergo of contracting the disease. Sometimes this inflammation of

the smaller air passages is accompanied by a dilatation, giving rise to bronchiectatic cavities of considerable size filled with pus, and containing enormous numbers of organisms.

The first form of change found in the lung substance is the embolic abscess. These are explained by the occurrence of infected thrombi in the veins in the interior or in the neighbourhood of the lymph glands. They are characterised as follows—usually round, of small size, and irregularly disseminated through the lung tissue. They are unlike most pyæmic lung abscesses in being white in colour, with a slight yellow tinge; also in their consistence, which is firm and almost caseous. These characters, and the fact that the area is bounded by a dark hæmorrhagic zone, remind one of the nodules in the lungs of horses suffering from glanders. At the margins of the lobules the areas unite to form larger pale areas of infiltration not unlike tubercle. Over such areas, when they are near the surface, there is, of course, a fibrinous pleural exudate.

The second form of lung change are the lobular or lobar areas of hepatisation. These undoubtedly have their origin in the air passages. The naked eye appearances of hæmorrhage and purulent infiltration in such areas remind one of the appearance of the buboes. The microscopic changes are those of consolidation of the area of lung, the alveoli being filled chiefly with leucocytes. Fibrin only occurs in large amount in the neighbourhood of the vessels. The alveolar epithelium presents frequently a peculiar appearance. Instead of lying free in the alveoli, the whole lining endothelium is swollen and separated from the wall, forming a ring round the exudate.

In all cases of lung infection bacilli were present in enormous numbers, forming no inconsiderable portion of the alveolar contents, and being visible, when in masses, with a low power of the microscope.

The third form of lung change is the isolated area of splenisation, representing a circumscribed primary hæmorrhage in whose neighbourhood inflammatory processes are going on. This may pass on to the second form.

An important question is the origin of the lung infection, whether primary or secondary. The author considers that it has been too generally assumed that primary pneumonia may occur. In several of his cases which appeared on the surface to be primary in the lung, lymph gland infection was discovered on more careful examination. In only one case was there found extensive pneumonia without implication of glands. In this case pneumococci were present in the lungs along with plague bacilli. This was probably a case of secondary infection with plague.

Of the other organs of the body, the one which exhibits the most constant changes in plague is the spleen. Usually it shows considerable swelling, and both macroscopically and microscopically reminds one of typhoid fever. The pulp is soft in consistence, and greyish red in colour. The follicles are usually small, and sometimes entirely obscured. On microscopic examination there is found enormous increase of the endothelial elements of the pulp. These appear as large crescent-shaped cells, specially well seen in fresh film preparations; they are also characteristically present in typhoid. Not to be confused with these are the large star-shaped or polygonal, often multi-nucleated cells, which may occur in the centre of the follicle. Their origin is not quite clear. These have been observed by the author in large numbers in several cases.

Bacilli are also found in large numbers in the spleen. They lie in masses usually in the neighbourhood of the small splenic arteries, or in the periphery of the follicle between the cells, less often distributed through the pulp.

Parenchymatous organs, such as liver and kidneys, show the changes characteristic of acute diseases, *i.e.*, cloudy swelling and early fatty change. A peculiarity in the liver is the accumulation of lymphocytes which may be observed. In one case there were multiple embolic abscesses, with large numbers of plague bacilli.

In the kidney the glomeruli seem to be the structures specially affected. They may be recognised macroscopically to be enlarged; with the microscope, hæmorrhage and epithe-

lial desquamation, associated with the presence of large numbers of plague bacilli, are to be observed. In such cases the urine of the patients must contain bacilli in large numbers. In the more marked cases the microscopic changes in the kidneys resemble to a great extent those of scarlet fever.

Petechial hæmorrhages in the mucous membrane are another common accompaniment of plague. The author found these specially well marked in the stomach in one case,

JAMES MILLER.

REPORTS OF SOCIETIES.

BRITISH MEDICAL ASSOCIATION.

BIRMINGHAM BRANCH.

PATHOLOGICAL AND CLINICAL SECTION.

A MEETING of the Section was held at Birmingham on March 31, 1905, Dr. T. S. SHORT in the chair.

Lupus of Pharynx.—Dr. Lamb showed a case of lupus of the pharynx. The patient was a farmer, aged forty-one years; he felt quite well, and was able to do hard farm work. About three years ago he felt some discomfort in the roof of his mouth, and noticed that he could not breathe freely through the nose, but the trouble was so slight that he did not consult a doctor for eighteen months. He then came to the hospital, and his palate and pharynx were found to be extensively diseased; all the visible parts of the pharynx were involved. At present the faucial pillars, tonsils, and walls of the pharynx presented one continuous diseased surface, from which the usual landmarks were obliterated. Part of the hard palate and the whole of the soft palate and uvula were also affected. The soft palate was completely adherent to the posterior pharyngeal wall, except just behind the uvula. The diseased surface presented in some parts a typical nodular deposit, in others irregular "worm-eaten" ulceration, and in others cicatrisation. The epiglottis and larynx were free from disease, and so were the nose and the skin. Treatment with caustics, paints, and curetting produced great improvement, but the disease relapsed when treatment was stopped. It was proposed to try multiple galvano-puncture.

Case for Diagnosis.—Dr. Willoughby Gardner showed a case for diagnosis—a child presenting a peculiar malformation of all the bones of the arms and legs, and especially of their articular cartilages.

Adiposis Dolorosa.—Dr. Douglas Stanley showed a woman, aged forty years, who for ten years had complained of subcutaneous swellings in the upper and lower limbs; the size of these varied from one and a half to three inches in diameter; some were painful and tender; others tender without being in themselves painful. They were slightly lobulated on palpation. The patient was subject to periods of mental depression. There was no evidence of neuritis. Both ovaries had been removed several years previously.

Congenital Stenosis of Duodenum.—Dr. Willoughby Gardner showed the stomach, duodenum, and upper portion of the jejunum from a case of congenital stenosis of the lower end of the duodenum. The child had lived for nine weeks, and had died from persistent vomiting, which commenced when it was a week old. The stomach and duodenum showed great hypertrophy and dilatation.

Panhysterectomy for Fibroid.—Dr. Purslow showed a specimen of uterus with fibroid removed for uncontrollable hæmorrhage after abortion. The patient, a multipara, showed signs of abortion at the eleventh week of pregnancy; as the hæmorrhage was severe, Dr. Purslow was asked to see the case in consultation; he found the os open, and the ovum, with a large amount of blood clot, in the uterine cavity. The uterus was cleared out under an anæsthetic, curetted, and packed with iodoform gauze. An interstitial fibroid the size of a small orange could be felt in the right wall of the uterus. When the packing was removed at the end of forty-eight hours, bleeding re-commenced; the uterine cavity was washed out and again packed with gauze, but the hæmorrhage recurred on its removal. As the patient's condition was becoming serious, the abdomen was opened, and the uterus with the tumour removed by panhysterectomy. Patient made a good recovery, and is now, ten months later, in excellent health.

Patellar Flexion-Dislocation.—Mr. Wm. Thomas read notes of the condition he called patellar flexion-dislocation, in which the patella became dislocated when the knee was bent, but the joint was quite normal when straight. He

alluded to the difficulty of curing such cases either by operation or appliances. He read notes of a case on which he had recently operated successfully, where the dislocation was apparently caused by nodular bodies which were contained in cavities in the quadriceps extensor about the patella, in such a position as to push out the patella when the knee was bent. He had removed two of these bodies, which he exhibited. They were white, hard, and nodular, somewhat oval in shape, and about an inch in the longer diameter, by three-quarters of an inch short diameter. He considered these coral-looking growths to be hypertrophied, calcified, detached, synovial fringes.

MIDLAND MEDICAL SOCIETY.

A MEETING of this Society was held on Wednesday, March 15, the chair being taken by the President, Mr. WOOD WHITE.

Mediastinal Tumour.—Dr. Douglas Stanley showed a man, aged twenty-eight years, who for six months had suffered from pain in the chest, slight cough, and expectoration without blood. His face showed congestion, and the voice was hoarse. Physical examination of the chest showed an extensive area of dulness in the upper mediastinum, extending to the left, deficient breath-sounds over the left lung, and impaired resonance posteriorly in the left scapular area. The superficial veins of the thorax and abdomen were much engorged and distended, the direction of the blood current being downwards. Dr. Stanley considered the case to be sarcoma, originating in the upper mediastinum.

Dr. Purslow showed a specimen from a case of irreducible prolapse. The patient was admitted into Queen's Hospital on June 4, 1904, with a large mass protruding from the vulva, which had not gone back for six months. The vagina was completely everted, and the uterus lay entirely outside the body. Near the centre of the posterior vaginal wall was a small aperture, from which pus was exuding on pressure, and

into which a fine probe could be passed about one inch. Attempts at reduction under anæsthesia, after the patient had rested for a week in bed, failed, and so the uterus, with a large portion of the posterior vaginal wall, was excised. The operation was rendered difficult by the bladder being unusually adherent to the anterior wall of the uterus, and by inflammatory thickening of the vaginal wall, the portion of the latter in the specimen showing a thickness of at least an inch. The left ovary was found to be connected into an abscess cavity, and to be communicating with, and discharging through, the small hole already mentioned in the posterior vaginal wall. The patient made a good recovery, and the result of the operation has been quite satisfactory. The parts shown were the uterus with the vaginal wall attached and the left ovary.

Dr. A. W. Nuthall showed a specimen of intussusception.

Dr. J. W. Russell read a paper on "Paroxysmal Abdominal Pain, associated with Symptoms of Epilepsy."

KIDDERMINSTER MEDICAL SOCIETY.

A MEETING of this Society was held on Friday, March 31, Mr. C. DENNIS FITCH (President) in the chair.

Cases and Specimens.—Mr. Lionel Stretton showed :—

(1) A man, aged forty-nine years, who was admitted to the hospital suffering from an incised wound at the back of the wrist caused by a piece of granite flying against it when he was stone-breaking. His fingers were flexed, and he was unable to extend them. On opening the wound, it was found that the three tendons of the extensor communis digitorum and the tendon of the extensor indici were all of them divided as they passed through their compartment of the annular ligament. They were sutured with catgut, and now (after two months) he has a good extension movement.

(2) Thirty gall stones, weighing eighty grains, removed from a woman aged forty years.

(3) A small, irregular-shaped gall stone, removed from the cystic duct of a lady aged forty-six years. She had a

severe attack of hæmatemesis nine years ago, and had been unable to take solid food since. Within a fortnight of operation she was able to take full meals without discomfort.

(4) Two appendices. (1) Extensively gangrenous, with a large perforation. The man, aged twenty-four years, had only been ill three days. When operated upon, there was a considerable amount of peritonitis. (2) Showed a horseshoe-shaped appendix with a constrictor. It was removed in the quiescent stage from a girl, whose right kidney was at the same time stitched to the loin to prevent its undue mobility. Recovery uneventful.

Dr. Bertram Addenbrooke showed :—

(1) A woman, thirty-two years of age, who had been suffering from phthisis three years. The disease had caused so much contraction of the left apex of the lung that the heart was drawn up so that its apex beat was in the third intercostal space.

(2) An appendix which he had removed. The patient had had two attacks of appendicitis. The appendix was adherent, and there was a small abscess.

(3) A large nasal polypus.

(4) A large cervical gland which shelled out.

Mr. G. D. Dykes showed a woman suffering from peripheral neuritis. Patient had suffered from sickness and vomiting for several years. Twelve months ago was treated for gastric ulcer; improved. Five months ago pain in stomach and vomiting returned. Bowels very constipated; thinks they have been moved twice in last four weeks. Middle of December had pain in wrists and ankles, travelling up forearms and legs, with gradual loss of power and inability to straighten fingers and extend hand or forearm; left foot affected in similar manner, though less severely; has lost flesh rapidly last few months. Teeth all extracted five months ago. Patient very anæmic and emaciated. *Nervous system.*—Marked tenderness along ulnar and median nerves of both forearms, and of external popliteal nerve of left leg; knee jerks of both legs greatly exaggerated; triceps jerk distinctly present; slight anæsthesia of three inner

fingers of left hand and also right; cannot extend fingers at all; power of extension of both hands and left foot greatly diminished. Pupils respond to light and accommodation. Two slight blue specks visible on gums. Patient, a married woman, had five children—two living, three dead—and latterly several miscarriages.

Mr. Lionel Stretton read an interesting paper on "Antisepsis and Asepsis," which gave rise to considerable discussion.

Mr. E. S. Robinson referred to some cases of hospital abuse which had come to his notice.

NEW DRUGS AND PREPARATIONS.

MESSRS. BURROUGHS, WELLCOME, AND CO. have sent some of the latest additions to their list of tabloid preparations.

Veronal.—This has become a popular hypnotic, and the tabloid preparation (0.5 gramme, 7.71 grains) is a handy form for prescribing.

Antifebrin Compound.—This tabloid contains: Antifebrin (Acetanilidi P.B.), gr. 2; caffeine citratis, gr. 1; camphoræ monobromatæ, gr. 1. The composition of this tabloid indicates its use in cases of migraine, and from trials we have made we believe it is a good preparation.

Tabloid Zinci Valerianate with Iron and Arsenic.—The proportions are:—Zinci valerianatis, gr. 2; ferri redacti, gr. 1; acid arseniosi, gr. 1/60; ext. gentianiai, gr. 1. Valerian compounds being difficult to prescribe in an agreeable form, this tabloid is certainly convenient.

Tabloid Glycero-phosphates Compound contains calcium, sodium potassium, magnesium, and iron glycero-phosphates, combined with pepsin and diastase. Each tabloid is equivalent to one-half drachm of the syrup of glycero-phosphates. It is a convenient tabloid, as it is frequently necessary to take some similar preparation when travelling.

Tabloid Ferric Chloroid and Arsenic.—The quantities are:—Tinct. ferric perchloride, m. 10; acid-arseniosi, gr. 1/30. This is also a useful tabloid.

Tabloid Three Valerianates contains:—Quininæ valerianatis, gr. 1; ferri valerianatis, gr. 1; zinci valerianatis, gr. 1. The addition of quinine to the valerian preparations is an advantage in many cases.

BOOKS RECEIVED.

From William Green and Sons, Edinburgh and London—

An Introduction to Physiology. By L. A. HODGKINSON LACK, M.B.

From Macmillan and Co., Ltd., London—

The Historical Relations of Medicine and Surgery. By T. CLIFFORD ALLBUTT, M.A., M.D.

From W. B. Saunders and Co.—

Tuberculosis. Northnagel's Practice.

Diseases of the Intestines. Northnagel's Practice.

Diseases of the Liver, Gall Bladder, and Bile Ducts. By H. D. ROLLESTON, M.D.

Gall Stones and their Surgical Treatment. By G. A. MOYNIHAN, F.R.C.S.

From E. H. Blakeley, London—

The Diagnosis and Treatment of the Common Diseases of the Rectum and Anus. By CECIL LEAF, M.B., F.R.C.S.

Charts for Recording Diseases of the Rectum. By CECIL LEAF, M.B., F.R.C.S.

From John Wright and Co., Bristol—

First Aid to the Injured and Sick. By WARWICK and TUNSTALL. Third Edition.

From John Bale, Sons, and Danielsson, Ltd., London—

The Radical Cure of Corns and Bunions. By E. HARDING FREELAND, F.R.C.S.

INGLEBY LECTURES.

MENTALLY DEFECTIVE CHILDREN.

By JAMES KERR, M.A., M.D.

LECTURE I.—THEORETICAL ASPECTS.

Introduction.

HERE we celebrate the memory of a father and a son who not only served their day and generation faithfully and well, but also have contrived by their lives and in their death to do something to serve those who more remotely follow them.

Dr. Ingleby rose to great eminence through the country-side that looks to Birmingham as its centre. His reputation was gained by his skill and knowledge in the ills that beset his women patients, and it was the desire of his son that subjects of interest arising out of the father's life work should be dealt with in the Ingleby lectures. Great physicians and distinguished surgeons have submitted the best of their work in these memorial lectures, and have felt honoured thereby. I have no great work to submit, but I feel deeply honoured that fortune should have associated me with the Ingleby Lectureship, because the work of a school doctor has to do with mentally-defective children, which is the subject selected for this year's lectures, and a subject concerning which a thoughtful man like Dr. Ingleby, as a result of his experiences, must have pondered much and often.

Feeble-minded Children.

What are they? How shall we define feeble-mindedness? This embraces a wide and heterogeneous field more easy to understand when seen than to define in words.

We can call it mental weakness in some directions associated with imperfections of the nervous system. There are many considerations both theoretical and practical that have

to be put forward, and in this lecture we will deal chiefly with certain theoretical matters, leaving the practical till next week.

No study of the mentally feeble child is possible except by continuous reference to the normal; on the other hand, study of the mentally defective is of great utility, and full of suggestion for the treatment of ordinary children.

By deductions from the facts of comparative anatomy and embryology the evolutional history of the nervous system has been sketched out.

The mental life of the individual is made up of the functioning of his nerve cells. Conscious action is only a part of this mental life, perhaps only a small part, although to the individual it seems to be all.

Far away back in animal history lies the simple nervous control exerted by the sympathetic system, and later comes the quick machine-like response of the spinal reflex, possibly at one time a conscious accommodation, but now unconscious and from long-established use almost unalterable by environment or education.

These make up the lowest level structures of Hughlings Jackson's scheme of the nervous system. Further on in the scale, later in animal history, appears the grouping and control of these reflexes by the centres placed in the brain ganglia and cortex. These include also the simple cortical representation of the senses, as vision and so forth, and constitute the middle level of Jackson.

They begin to function soon after birth, and appear in a regular course which has not yet been fully worked out, but which is of great educational interest, which also may some day be of importance in the early diagnosis of feeble-mindedness.

It is probable that much of the vivid conscious life of the young child is made up of the functioning of these centres, which later are almost unconscious and automatic in their action. Of latest evolved function on this level we may regard those which are most human as being the most liable to variation, and the use of the hands in finger movements,

the muscles of articulation, macular vision and convergence of the ocular axes, are almost peculiarly human, and these would be directions in which one would expect to find variation.

When the highest level of Jackson is reached, we come to the structures which control and regulate the cortical representation of senses and movement. The regions where are stored memories of combinations of sensory impressions and movements.

In the Bowman Lecture to the Ophthalmological Society last November, Dr. Mott has demonstrated the gradual building up of the structures which subserve vision. By a series of beautiful studies on mammalian brains, extending from those with the lowliest visual functions like the insectivora and rodents, through all classes, moles and mice, cattle, horses, cats, dogs, to monkeys and men, he has shown how from simple panoramic vision with each eye singly to the binocular stereoscopic fields which we ourselves enjoy, there is increasing complexity of structure in the visual cortex, and finally with the use of the hand and ideas of form, substance, extension and the qualities of objects, the formation of associational layers of neurones in the visual area connecting with the auditory and motor centres becomes greater in proportion to the specialisation of the fore-limbs.

These memories of the movements and sensations in their varied groupings, which are so richly stored up that their anatomical bases can be described, in their functioning during development, which lasts into school life, are probably conscious and highly fatiguing, but this diminishes as function becomes more perfect, till later they probably to a great extent become automatic and unconscious from habit. These memory groupings are, however, but the materials for reasoning and thinking. The very highest regions of all, the centres which direct attention, involve at all times conscious action, and are the earliest to be affected by fatigue, environment, drugs or disease, are also the most liable to spontaneous variation. All that can be said is that it has been observed that nerve fibres, before they become functionally established

in activity, have to acquire a fatty coating, the myelin sheath, and that there are areas of the brain surface, great silent areas whose functions are accomplished, screened behind the lower level cortex, but whose work to judge from the time at which the nerves going to them become myelinated does not begin till the child has started well on its way in life. These late developing areas must be connected with high and very specialised action, and must be the areas wherein is greatest spontaneous evolutionary variation, but of all this as yet we can only confess our ignorance.

Probably the frontal or pre-frontal regions have to do with attention, and the capacity for sustained attention is the most delicate evidence we have of perfection in mental development.

We have spoken of the highest level of the nervous system as consisting of not only the regions where are stored memories of complex sense impressions and intricate muscular combinations, but also the very highest layers or areas which associate all the memories, directing and maintaining attention in conscious thought.

These levels are the only parts which formal education can modify to any great extent, and they are the latest evolved in the race and the individual, and where variation spontaneous or abnormal is found to the greatest amount.

The efficiency of their functioning depends on their structure due to heredity, to environment in the way of (*a*) nutrition, (*b*) exercise by training during the plastic period.

Probably the greater part of the daily actions of our lives are sub-conscious; we do the proper thing unthinkingly because earlier we have done it consciously and as the result of due judgment; and now lower centres have become so adjusted that the higher regions whose action involves consciousness and increased readiness of fatigue are, as it were, short-circuited. This constitutes habit, and good habits to a great measure constitute success—saving time and reducing mental wear and tear.

The possibility of good habits, right conduct and clear thinking is bound up with clear-cut sense impressions, and definite and efficient motor acts.

We can only do little to train sense impression, or make muscles more efficient. Education is mental training. The trained blind man has not an acuter touch than the skilled workman, but his interpretation of his sensation is more accurate. The sailor man has not acuter vision, but interprets what he sees better from training and experience; but certain faults are common, and correction is necessary for good education. The necessity for a clear image on the retina is the first requirement for vision. Correction of the refraction is a preliminary to clear thinking (a preventive of mental short-sightedness).

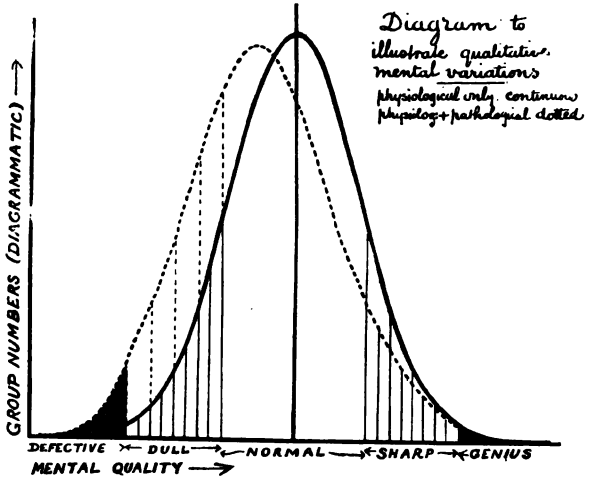
Apart from the general question of improved nutrition and audition, the removal of adenoids seems in some way to actually affect the lymphatic circulation about the base of the brain, and hence affect its nutrition. As a practical clinical observation, there can be no question as to the mental clarity contributed by a successful operation for removal of adenoids, or the reduction of turbinate congestion or hypertrophy.

Individuals vary enormously in relation to mental qualities, and the expression "feeble-mindedness" expresses to some extent failure to reach a certain level in the general summation of the mental qualities. But the discrimination of these individuals into actual classes presents difficulties.

Suppose a large number of individuals who are in all other respects healthy, and whose mental condition in relation to some one quality—say, their readiness of response to a signal—could be assessed numerically, we could distribute these individuals into groups according to the value of this particular quality, and the distribution would give a curve as illustrated. The most being those of average quality, the smaller group on the right as one looks at it being smart, then smaller still very clever, and finally one or two geniuses; the converse being the case for dull, feeble-minded, and imbecile, as shown on the other (left) side. And if all brain qualities could thus be summarised in people normal and healthy in all other respects, we should get such a distribution which, I take it, represents the normal condition due to physiological variations of brain structures.

Where we draw the separating lines is entirely a matter of choice, and the classification is exceedingly difficult, as one shades into the next.

Now if, using the same standards of mental quality, we take all kinds of people—healthy and unhealthy—and plot out the curve, it would come out something like the dotted one, for, although the toxins of some diseases in their active stages may stimulate nerve cells, the general result of disease is to reduce functional capacity. A very considerable increase of the left-hand side—the dull and feeble-minded—over the right side—the bright and gifted—although it is impossible to draw



hard and fast lines of separation. It will be seen later that this difficulty of delimiting the various classes has a political bearing in pointing to the necessity of one authority having the responsibility for all classes of feeble-minded and normal individuals in matters that concern their mental condition.

The classification adopted is purely empirical. Children who cannot receive proper benefit in the ordinary schools, and are not merely dull and backward, nor imbecile, are to be regarded as feeble-minded, and suitable for education in special schools.

If they are incapable even of receiving proper benefit in a special school, they are presumed to be imbecile.

Individuals forming the very worst class are called idiots. So that the classification may be made :—

Normal (and super-normal).	
Dull and backward	Feeble-minded (American).
Feeble-minded (English)	
Imbecile	
Idiot	

So difficult is the classification that some writers put in intermediate classes such as idio-imbecile and so on, whilst others separate into higher, middle, or lower grade imbecile, and so on.

Merging on the feeble-minded is the great group of "dull and backward." Sometimes the mental defect is temporary, and we may use the term "spurious mental defect" for many of these children who are wanting in knowledge and spontaneity from a condition that may be due to debility, from want of proper nourishment, and exhaustion from needed rest and sleep, privation of natural education, and the constant worry of unsuitable environment.

Some of these cases are associated with obvious (although possibly previously unrecognised) obstruction from adenoids, surgical treatment of which often clears up a case of apparent mental defect.

The term "aprosexia" has been given to the peculiar mental state of which one of the chief characteristics is inability to fix the attention from which children with adenoids suffer. They are peculiar children, and the use of "peculiar" by a teacher is very suggestive of adenoids in the child.

A large group are merely debilitated from illness, and among poor people crowded in large towns it is astonishing how one zymotic treads on another, and how great a part of the earlier years of school life in some children is taken up with absence through infectious disease.

For this mass of children, distinctly sub-normal in mental qualities, although possibly from removable causes, a simpler education is wanted. The education of the senses and the motor cortex chiefly by doing; the functioning of the higher

association centres being indirectly elicited. For these children, who may be very roughly estimated as constituting about a tenth of the ordinary school population, intermediate schools should be provided, and every child who showed any difficulty in its school work should pass into an intermediate school where cleanliness would be made much of, regular drill, good attitudes and automatic obedience be insisted on, easier and simpler tasks would be given, and life presented in a more concrete form than usual. With more individual attention, the child, either catching up in his work, would return in a few months to the ordinary school, or, remaining here under an education adapted to his capacity, would not be wasting time, as so many are in the ordinary school; or, if unable to keep up here, would pass into the special class, or even to the imbecile asylum. This is the natural stage in educational development which should have preceded the institution of special schools.

There is another group, fortunately very small, which, however, must be distinguished. The Idiots Act of 1886 (49 and 50 Vict., Cap. 75) says: "Idiots and imbeciles do not include lunatics. Lunatic does not mean idiot or imbecile." It is generally taken that a lunatic has possessed normal mental conditions, which, through accident or disease, have passed into a state inconsistent with the normal conduct of life. He has at some time got worse, whereas the feeble-minded, idiot, or imbecile person has never possessed normal mental powers, and, as a rule, remains stationary or improves in this condition.

My own experience is practically confined to children who come within range of the Education Acts, that is, the normal, the dull and backward, and the feeble-minded (in the narrow English use of the term), with a few imbeciles who are difficult to differentiate from the feeble-minded. The pronounced imbecile and the idiot we at once exclude as unsuitable for our schools, and they thus pass from my knowledge.

The whole provision for the mentally-defective class of child is comparatively recent in England. In the year 1890, except for such institutions as Earlswood and the Royal

Albert Asylum at Lancaster, there was no public provision except for paupers.

The Report of the Commission which resulted in the Blind and Deaf Act in 1893 said (page cvi.) : " With regard to feeble-minded children, they should be separated from ordinary scholars in public elementary schools, in order that they may receive special instruction."

Classes for such instruction were started here and there throughout the country, a class which I remember visiting at Leicester being the first formed in the spring of 1892. A Departmental Committee inquired into the whole subject, and the Education Act (Defective and Epileptic) of 1900 resulted.

This Act has been extensively adopted as far as regards the mentally and physically defective, but till recently, owing to quite impracticable financial requirements, its provisions for epileptics have remained a dead letter.

Owing to the recommendations of the Committee having been passed over as regards imbeciles, there is no statutory duty laid on anyone for the care of imbeciles who are not paupers. These children are excluded from school and become greatly neglected, constituting a very serious social danger, and such considerations have at length led to the appointment of the Royal Commission now sitting to consider the care and control of the feeble-minded of all classes.

Theoretically, there should be the two great classes of feeble-minded which have been indicated :—

I. Physiological (due to normal variation).

II. Pathological (due to the results of disease).

There exists, however, a large indeterminate class, which it is impossible to differentiate as yet.

The first class, physiological variation, although less numerous, are of much greater importance educationally than the larger group.

Their study should throw much light on the development of brain functions and on the methods to be adopted for the education of normal children.

Much of the work up till quite recent years, both in respect to lunacy and to feeble-mindedness, imbecility, and idiocy, had to be done under great difficulties, there being no

localisation to help the observer even to grope his way; but we have such broadly outlined now, and may hope for more rapid progress.

The old writers treat these cases as if they had to deal with disorder of the whole brain, and even yet we have the idea of idiocy persisting in such anomalies as the description of a seventeen-year-old boy as a high-grade idiot, whose record says that he has "pleasing address and courteous manners, has a wonderful talent for music, plays equally well on piano or organ, either at sight or by memory, and improvises and composes without effort; is an apt translator of foreign languages, has wonderful hand skill which he is capable of utilising as the purpose of the moment demands; is an excellent type-writer and accurate above the average." Obviously here there is much that is excellent, and some comparatively limited and undiscovered aberration of brain structure.

The first step in the analysis of brain functions was the recognition by Broca, nearly half a century ago, of the association of certain of the speech defects known as aphasia with disease of a small part of the brain, in the third left frontal convolution, since that time known as Broca's Convolution. Since then the different varieties of aphasia have been separated and related to disease or injury of varying parts of the brain, but these have all been in cases of acquired disease.

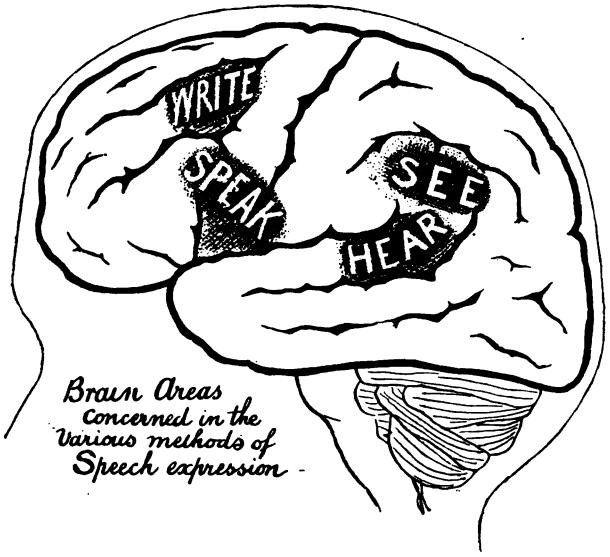
The investigation of congenital aphasia has only been begun in the last ten years. and yet it presents a group of symptoms capable of exact study and belonging to functions so lately evolved that one might *a priori* have expected to find variation here if anywhere.

The French Alienist Esquirol had already attempted to classify mentally-defective children by speech defects, beginning with the lowest grades who had no speech, and rising by grades who used single words, then single phrases, to complicated sentences.

In the natural course of evolution we should have gestures first, then sounds and words, and finally sentences, first

spoken sentences, ultimately written. Speech is entirely conventional, and its written form highly artificial and only acquired by education; here, then, we may find definite symptoms.

For the sake of simplicity, let us consider first only the words that constitute speech symbols. They may be spoken or written, that is, to be heard or seen to be appreciated.



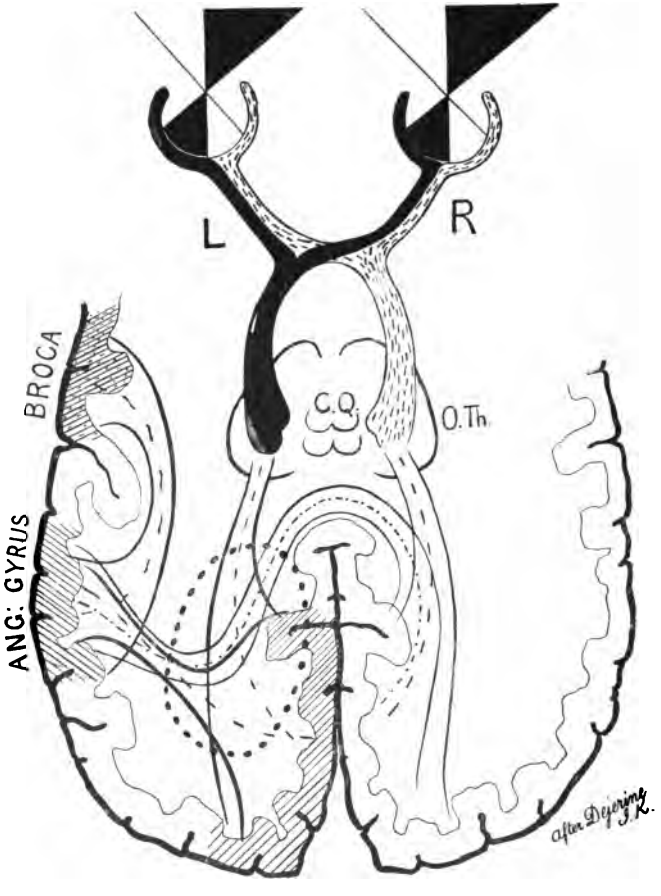
In the case of words seen, the nervous mechanisms involved have been well worked out in connection with the cases arising in adults from disease.

The image of the word falls on the retina, and its representation is carried to the visual cortex in the occipital lobes. From these, nervous impulses pass to the left angular gyrus, where the memories of visual word images are stored. In connection with the functional state thus originated in this area, probably by representation to a higher centre, attention is turned to the word, and consciousness of its meaning established.

There are two forms of word blindness : That in which the centre for word memories is damaged, where no visual word memories can be used, where the patient cannot read words,

nor can he use visual word memories for writing, but there need be no other symptoms. This is exclusively the form met with in defective children who have word blindness.

The other form of word blindness occurs from disease and consists in interference with the visual path, cutting off the access of visual impressions from the angular gyrus. As this



interference to produce word blindness must cut the paths from both right and left occipital regions, it is necessarily in a comparatively limited tract in the left side where it also interferes with the path from the retina to the left occipital cortex. so that we have blindness of the left half of each retina (hemianopsia).

In this case the angular gyrus remains intact, and the patient can use his word images stored there to write correctly, either to dictation or spontaneously, but no word images can reach it from the eye, so that he cannot copy writing or even read what he has written. In the case of the congenitally word-blind child there is always inability to write correctly (agraphia).

So far the left angular gyrus has been referred to as the centre for word memories. In left-handed people it is the right angular gyrus that is affected, and in some cases where an adult has slowly recovered the power of word memory it is supposed that the right side may take on function, and cases have been noted where later the right side has been affected and function permanently lost. As no improvement occurs in simple word blindness in congenital cases, we assume a symmetrical want of development in the angular gyri of both sides.

A person who is merely word blind will be able to understand all said to him, will be able to converse rationally, and, except for inability to recognise words, will be normal except that he cannot read or write intelligible words.

There are all degrees of word blindness, downwards from the ordinary bad speller to the individual who cannot recognise any word. Strange to say, these cases can generally recognise simple symbols. The Arabic numerals are usually preserved so that the children can do arithmetic so long as it does not involve any written words. Thus, a boy who could not distinguish between OR and AS could do long division of money easily. Most of them can learn their letters, but stick at the combination into words; but the learning of a letter does not necessarily involve the recognition of a visual symbol as such by the angular gyrus, and possibly this is true too of numerals.

In the cases of aphasia in older people, coming on from disease, there are some difficulties in explaining why letters and figures are generally retained; the same is often true of musical notes. Some facts suggest that different ideas have different localities for storage in the brain, so that cases are

described where letters have been lost whilst words have been retained, or where words of one language have gone whilst others have remained, and so on.

At the same time, allowing due weight to these cases, there is still a comparatively simple explanation.

The recognition of a letter by a young child is distinctly aided by size, not that it sees it any clearer, although possibly there is a more brilliant representation in the field of consciousness, from stimulation of a larger retinal area, but more probably, to judge from the mistakes children make, and from the fact that a certain time is necessary for recognition, the child recognises the letter from the sensations of movement of its eyes as the axis of vision moves over the surface.

This is where the tracing of letters in sand, or making them out of pliable wire, comes in so very usefully in the child's learning a visual knowledge of the letter form. And the figure memories and letter memories are thus stored in either Broca's convolution (or neighbouring motor regions) for the eyes, whilst word memories are in the visual angular gyrus.

Once the symptom complex is known, it is comparatively easy to detect these cases. Recently a case was noted in London by a teacher as suitable for examination by the school doctor because of "word blindness." She had formed what turned out to be a perfectly correct diagnosis after hearing a lecture at the Child Study Association by Dr. Shuttleworth.

English is essentially a language of logograms. Spoken English is a very easy language for the foreigner, but written English one of the most difficult. We do not learn English words by spelling, but as a whole by word memories, and this is the reason why all spelling methods with phonetic values and coloured letters and so forth are comparatively useless except as providing an interesting amusement for the babies. They are instructive, they are amusing, they interest the children in finding out things for themselves, but they do not teach them to read. In fact, reading is, if anything, hindered.

In some cases the word blind can recognise one or two words such as NO by kinæsthetic memory, but stick at such as YES. Thus a few days ago, a boy of twelve years, who summed mentally and almost instantly 5s. and 2s. 6d. and the half of 3s. 6d. added to it, whose ear could at once recognise a word spelt over to him, could not spontaneously write any word of "hat," "rat," "mat," "fat," "bat," nor could he distinguish "cat" when written among these words, nor indeed tell any single one of the half-dozen. His mother could do so, although she could not read, in spite of having gone to school regularly for eight years.

In marked cases attempts to educate the visual centre are hopeless; what is learned one day is forgotten the next; and in the class we have to deal with, visual education, as in the case of this boy's mother, is hopeless for any practical purpose. Education by motor memories and the ear must be trusted to, and possibly is really what happens in cases of word-blindness which are supposed to learn by frequent and repeated practice.

Now, to pass to the other method of recognising words, by the auditory route, as our boy did. A person may not be deaf, but may fail to understand a word; the word-sound memories do not exist, so that he is as if he were listening to a foreign tongue; he hears, but it means nothing; he understands the other sounds around him, although a certain amount of intellectual obtuseness to the meaning of other sounds is often also apparent. As an uncomplicated result of disease, these cases are very rare.

In very young children there is a certain amount of intellectual failure in appreciation of many sounds; the testing of hearing is notoriously more a test of mental than aural qualities with young children, and in certain cases where partial deafness comes on as a result of disease the question of mutism or not depends on the child's intellect.

In one case of a boy of five years, mutism came on in the course of six weeks after the beginning of mumps, which left nerve deafness behind, but he was found afterwards to be mentally dull, and by the age of twelve years was classed as mentally defective.

It has long been taught that if a school child hears, but does not speak, it is an imbecile, but even as a rough generalisation this cannot be taken as correct. He is very likely to be treated as imbecile, although his only inability may be the lack of understanding for words spoken. Generally speaking, a word-deaf person is cut off from the first accession of speech, as it is through the ear that the other centres learn.

Knowing the existence of word blindness in children puts one on the lookout for the corresponding condition of word deafness, and the first case recorded was actually under my observation for two years before a definite diagnosis was made. As a child of four years he seemed alert, but did not understand and never spoke; at five he was shown to the school doctor, and between six and seven was transferred to a deaf school, to try the effect of articulation, but after some months, at the request of the head-mistress, was removed as imbecile. He was then put into a special class for careful observation, as he seemed to notice much, when, however, he was found not to answer his name. The idea of word deafness was raised, and attempts made to teach him the sounds by writing and articulation. He soon gained the words "pen" and "penny," and from that time a vocabulary was slowly built up. He learned writing quickly, and picked up speech by kinæsthetic memory. If a question was asked him, he repeated it noiselessly with his lips before he could understand it. He made good progress, and learned to speak and sing, with expressionless tones like a phonograph. He could draw well, and his father, who was a cabinet maker, said that he would make an excellent workman.

The difficulty of accounting for this boy's defect on any other ground than symmetrical want of development of the posterior third or right and left first temporal convolutions led to that explanation being adopted, also as the explanation in cases of congenital word blindness.

The word-deaf cases are much rarer than the word blind, and since writing this account I have come across a paragraph in Dr. Ireland's work which exactly describes the

condition they are likely to pass into, if the word deafness is not detected. He writes (p. 325): "There is a small class who may be styled idiotic aphasics who remain obstinately mute, though it is clear they have more intelligence than other children who talk volubly. Sometimes, indeed, they have so much intelligence that people doubt whether they are imbecile at all." Probably a good number of these are really intelligent children who are word deaf, and consequently have never had communication reach them for want of the first steps in education.

These word-deaf cases learn from muscular movements, from vision and writing, using an alternative route, just as the word blind will sometimes recognise a word by spelling out the letters aloud and recognise it by ear.

In a case which cropped up since the above paragraph was written, the child was word blind, and had also an extremely poor hearing memory, so that he did not recognise the simplest word shown, and could not pronounce it when it was spelt out to him, but if allowed to write it or to make the writing movements he said the word at once. Evidently this boy had a very vivid motor memory or muscular memory of words.

There is, then, a muscular memory of words, and many people (probably with insufficiently trained word vision, the result of improper methods of learning to read) can be seen in reading in a train or tramcar to be repeating each word silently as they go, augmenting their defective visual training by use of such muscular memories.

This muscular memory or motor word centre lies in Broca's convolution, the point from which brain exploration began. Whether there is a separate centre for writing memories or not is not absolutely determined (no case of pure agraphia having yet been seen).

In my own case, whilst I think that I read visually, I am conscious in writing of spelling each word by ear as I write. Whether there are separate centres for movements in spoken words, written words, and for the eye-movements in words seen, we cannot definitely say, but there should be structure

which correlates all these memories, directing, as it were, the attention to them possibly through representation elsewhere in the brain, and the absence of proper training of this attention means almost automatic reading, writing, or speaking of a comparatively useless character educationally, as it is done without effort and scarcely rises above the threshold of consciousness; and yet much school work of the present time is essentially of this nature.

In passing, it is as well to mention that curious cases of children who mutilate words, do not sound the first consonant, or only sound the first syllable and elide the rest, crop up as rarities. This lalling, to judge from literature, appears much commoner among the German-speaking people than in England. Perhaps, however, their teachers notice more carefully. The great and commonest defect among feeble-minded is imperfect articulation, a want of precision in the performance of Broca's convolution, but clearly-marked congenital motor aphasia I have not seen. In such a case the child would be fairly sensible, would understand spoken words, but would speak gibberish. It should not be mute. Dr. Wyllie quotes some cases which appear to come under this head, and others which are really sensory.

In a few cases we have ventured to class the speech disturbance as hysterical, the children understanding spoken words and writing perfectly, and being able to sound the separate sounds clearly, but not to form words, and the parents giving a history of the child having talked normally; but these cases are worth further study, as this history of a child having spoken up to the age of, say, three is very unreliable, and is sometimes got in the case of congenital deaf mutes.

There is one curious symptom which writers speak of as rare, but this is contrary to our experience. It is of considerable importance educationally. The symptom known as echolalia, stimulation of the auditory centre by a question addressed to the patient produces a repetition of the last word, or of the whole phrase. We usually regard this symptom as a very hopeless prognostic educationally, the idea

being that the functionally lower layers have been developed, but that the higher co-ordinating regions or layers associated with reasoning are either wanting or scarcely developed. The corresponding writing I have not seen.

Such is an outline of the physiological disturbances which constitute congenital aphasia as at present known.

These instances of aphasia have been treated at some length because they are of great interest to the educationalist, and also because we are on tolerably solid ground, but pure and uncomplicated cases are not common. At the same time, the symptoms are not uncommon in association with other mental defects or general feebleness, and should not fail to be detected. We must be prepared to find cases corresponding to those in association with all kinds of physical and mental defects.

Just as the conventional signs of written and spoken speech are memorised in certain regions of the brain, and failure in development of these limited regions leads to want of power to appreciate these conventions, so we may regard the body of memories stored up comprising the conventions which regulate our conduct in relation to society. It would require a psychologist to set out this body of memories in its various relations, but to me there appears little doubt that these conventions of civilisation in relation to conduct form "morality." A body of memories of the same order, and probably not more complex than written or spoken speech. Where are these memories stored? They are a very late evolution. We cannot localise them, although, if this statement of morality is correct, one should expect a localisation. In cases where these moral memories are not sufficiently retained, or from want of development are practically wanting, we meet individuals who may possess all their other faculties, who may even excel in certain directions, but who know no law but to satisfy their own emotions or appetites. Some of these moral imbeciles are clever children, but cannot learn moral conduct from teaching or by punishment. They will lie or thieve, swindle and deceive, without cause or reason. There are all grades of moral defectives,

but the bad cases of simple moral defect are probably about as rare as cases of word blindness. They are dangerous as examples to other children in school, and in after life prey on society according to their abilities to evade the law.

For some girls of the moral imbecile type, the London County Council have opened a special residential home.

The detection of this class of moral imbeciles is often missed as they pass through the ordinary schools without trouble. Thus the cleverest boy in one school department was a shy-looking, rosy-faced boy, with red hair and freckles, the son of very respectable, hard-working people. He looked the picture of innocence and health, but, from the confessions of others, the head-master knew him as the ringleader of all mischief, and that he was a most adroit thief and swindler, but clever enough to use others as tools, and ultimately he only fell into the hands of the police by accident.

Relatives, the family doctor, clergymen, even members of the education authority, give trouble in opposing the opinions of the teachers and doctor about these cases.

Barr in his recent work describes a child whom he had kept under observation from her sixth year till in her twenty-fifth year, having grown to be an attractive and even handsome young woman. She was released through the ill-advised efforts of some sentimental philanthropists, and soon followed the usual course of such cases through the maternity ward and the lock hospital.

Of another boy the same writer notes : " Adroit thief and a clever schemer ; he tells lies with such an air of truth that it is hard not to credit what he says. We have not attempted to educate him, assured that every mental acquirement would be prostituted to evil purposes, and that there is no hope of reformation, for there is no moral sense."

Dr. Kerlin, his predecessor, the late superintendent at Elwyn, notes another boy, " whose cleverness at first gives a pleasing impression, but who is so crafty and well able to convince those who have not had long experience of him, of his innocence of purpose. There is something fearful in his cool deliberate plan to do evil. If phthisis would develop, it

would be the happiest issue." One's own experience agrees fully with the American writers in respect to these children.

Fortunately, these cases are not common, but of the greatest importanee sociologically; their observation and detection at the earliest ages are almost a necessity. Education in their hands is simply the means of doing evil. They should be registered and known to the police, and through life kept under observation as carefully as are convicts on ticket of leave.

The very young child is quite ammoral; one cannot call it immoral. It is evident long after it can understand and speak that it has not developed the altruistic qualities which should make up 20th century behaviour to its fellows, yet this does develop in very different grades, and much influenced not only by spontaneous variation and heredity, but also by environment and education. These facts go a long way towards regarding the development of morality as similar to that of speech, and to explaining the very anomalous cases of the moral imbecile class of children, intelligent in every way but that of behaviour towards their neighbours.

These illustrative groups show how physiological variation in comparatively small anatomical areas may make enormous differences in the conduct of life. In the adult who has acquired a store of memories, and by disease has a sensory avenue closed, a very short time suffices to fall back on some other route; but with the yet uneducated child it is to be remembered that closing one gate may mean closing all, and that neglect to determine the existence of other available routes may mean hopeless isolation for the child. As the word-deaf child, if his flaw is not diagnosed, probably becomes practically an imbecile, so if correct knowledge is brought to bear in education he may yet take a normal position in life.

The order of evolution of the functions which we have been considering as of such importance educationally is of some interest. The child is a week or two old ere it gives any sign of response to sound or sights about it. It will probably begin with laughing and smiling to recognise its mother at about six weeks to two months of age. It begins

to understand the sounds about it, and, as far as speech is concerned, the word-hearing centre becomes functional first about the tenth month; the child understands long before it speaks, but the motor centres are getting into action, and from the second month the child babbles away to itself quite incomprehensible babble for a long time, and often is to a certain degree echolalic, the hearing and acting cells about the end of the first year reproducing words addressed to it, the associational structures at this stage being probably in the condition which is permanent in the defective children who are echolalic. Eight or nine months after beginning to understand speech, the time comes when the first signs of controlled motor speech appear. It is now eighteen months old, and in a month or two more the child will scrawl untelligently with a pencil if it gets a chance. It will even pretend to read if it has seen others reading. And now in the third year its visual images gradually seek to find expression through the hand; they are the earliest attempts at art, uncontrolled and unfettered by higher powers of judgment, and a very interesting chapter may still be written on this; but as by the third year end the babbling passes off, so, too, but much later, perhaps at the seventh year, the spontaneous drawing disappears. Writing is the last learned. Useless scribbling passes off, and some children begin to print (about their fourth or fifth year) letters on their drawings which they have picked up without ever having been taught, and in the earliest writing or printing some very interesting things are seen. Instead of writing or printing from the left to the right, it is quite common to have mirror writing. Mirror writing, which is not an uncommon symptom where disease has damaged the left side of the brain, and which is not uncommon among idiots and imbeciles, is much more common in the infant school than in the special classes. Among the feeble-minded it is distinctly rare, and with one or two exceptions the cases noted as doing "mirror writing," when first seen, have been found to write normally later when re-tested. The explanation of the mirror writing has been usually that it is due to the educated left side of the

brain acting through the right on corresponding muscles. This explanation fails to account for it in children. Young children are frequently ambidexterous, and, as their mental evolution proceeds, become right-handed. In the mentally defective and so-called criminal classes, ambidexterity is common, as the further specialisation in development of the right hand is not maintained.

In one little child, who later showed great mental powers, before the age of four she began to print on her spontaneous drawings, but the print was always reversed. And when set a copy in print, it was reversed when copied, and at first, even when pointed out, she did not see anything wrong. Later the first line copied was mirror wise, the second line correct, but the third mirrored, and the mirror lines were begun at the right hand and the correct lines at the left. The same child came in from a walk one day, and asked, what does SONAIP over the music shop mean. This early reversed reading and mirror writing indicates an alternating use of the brain on either side, and is, I believe, found in certain of the older Greek inscriptions.

Every case of a feeble-minded child which seems exceptional is worthy of long study for the light which it may throw on normal brain action, or on feeble-mindedness from disease. And the study of the class of child met in the special schools is of much greater importance than the observation of idiots or imbeciles.

In the education of such children the indications given by the psychologist and the physician may result in rapid educational progress. And for work of this kind there is only one key—the method of hard work—but such work cannot be applied properly in school. The children for special study must be kept under observation in a residential school, where observation by trained experts is the chief object, and where all the laboratory methods of psychology, physiology, and clinical medicine are available.

Observation of hysteria has thrown much light on mental phenomena. Suggestion, especially in slight hypnotic conditions, has revolutionised our ideas of conscious and subconscious actions, and through such means we have seen,

both in adults and children, the blind made to see, the lame to walk, and the palsied hands restored to grasp and feel, almost as if by miracle. Whether these means can be used to inhibit emotions and to develop useful habits in those whose conduct requires regulation in childhood, only the experience of a scientific observer in such an institution is likely to give us an answer free from bias and from the risk of premature judgment.

Would it be wrong to suggest that there is no place where the pioneer work of founding such a central observation home would be more opportune than in connection with the educational work of this great hive of industry? Such an experimental school for child study and continuous observation by experts would not only perpetuate the reputation and name of its founders, but would still further extend the fame of this University, and obtain results of value to the whole human race.

PHYSICAL CHEMISTRY AND ITS APPLICATIONS IN MEDICAL AND BIOLOGICAL SCIENCE.*

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(*Continued.*)

THEORY OF IONISATION.

WHILE discussing the laws of osmotic pressure, it was stated that equimolecular solutions of different substances have the same osmotic pressure; and also, in speaking of the depression of the freezing point of water, that equimolecular solutions produce the same depression. These rules, however, do not apply to acids, bases, and salts.

Thus, for example, if we dissolve, say, 1 mole (58.5 gm.) of sodium chloride in water and make the volume of the solution up to a litre, the freezing point would be not —1.85°, but about —3.35°. Similarly, the osmotic pressure of such a solution would not be 22.4 atmospheres, but about 40 atm. A molar solution of sodium chloride, therefore, behaves as if it contained not 1 gram-molecule, but $\frac{3{\cdot}35}{1{\cdot}85} = 1.8$ gram-molecules of salt in a litre. In order, therefore, to find what the actual effect of such a solution would be as regards osmotic pressure, we must multiply the normal value of the osmotic pressure by a factor, greater than unity, in the present case, 1.8, in order to obtain the actual osmotic pressure. This factor is called the isotonic coefficient, or sometimes van't Hoff's factor, and is represented by i.

To illustrate this abnormal behaviour of electrolytes, I give one or two examples from the work of de Vries, who employed the plasmolytic method :—

TABLE 6.

Substance.	Molecular weight.	Plasmolytic concentration.	Molar concentration per litre.	Isotonic coefficient.
Cane Sugar	342	6%	0.175	——
Sodium Chloride...	58.5	0.65%	0.111	1.57
Potassium chloride	101	1.2%	0.119	1.47
Potassium sulphate	174	1.43%	0.082	2.12

*Being a Course of seven Lectures delivered in the University of Birmingham, during the Spring Term, 1905.

Similar numbers also are obtained from measurements of the freezing point. Thus, a solution of sodium chloride containing 0.539 moles (=31.55 gm.) per litre, gave a freezing point of —1.85°, whereas a solution of cane sugar containing 0.539 moles per litre (=184 gm.) would give a freezing point of $-1.85 \times 0.539 = -0.997°$. Hence, for the solution of sodium chloride, $i = \frac{1.85}{0.997} = 1.855$.

We can, therefore, state the general law that *salts, acids, and bases when dissolved in water give solutions possessing an abnormally high osmotic pressure and an abnormally low freezing point.*

Now, not only do salts behave abnormally, but the behaviour is all the more abnormal the more dilute the solution: *i.e.*, the isotonic coefficient increases with dilution. Thus, whereas the isotonic coefficient of a 3.15 per cent. solution of sodium chloride is 1.85, that of a 0.27 per cent. solution is 2. In other words, the last solution has twice as great an osmotic pressure as what one would calculate simply from the molecular weight of the salt.

Without delaying too long over this point, I give in the following table some values of the isotonic coefficient for 1 per cent. solutions of different substances :—

TABLE 7.

	i		i		i		i
KCl	1.82	K_2SO_4	2.11	KOH	1.91	HNO_3	1.94
NaCl	1.90	K_2CO_3	2.26	NaOH	1.96	H_2SO_4	2.06
KNO_3	1.67	Na_2CO_3	2.18	HCl	1.98	H_3PO_4	2.32

We see, then, that the abnormal behaviour of salts, acids, and bases, as compared with organic substances, consists in the fact that they behave as if they contained more molecules of dissolved substance than one calculates from the molecular weight of the substance. It looks, therefore, as if the molecules of salts, acids, and bases break up in solution so as to yield a larger number of molecules—each of the parts thus formed behaving as a separate molecule.

Now we meet with a precisely analogous phenomenon in the case of gaseous substances. Most of you will remember that when ammonium chloride is heated, it passes into

vapour; but this vapour not only contains the molecules NH_4Cl, but also NH_3 and HCl, formed by the dissociation of the molecules of NH_4Cl. And we should find that if we had 1 gram-molecule of ammonium chloride in an exhausted vessel of 1 litre capacity, and we caused the salt to pass into vapour, the pressure which would be produced would be greater than with a gram-molecule of hydrogen under the same conditions of temperature.

Since we see, then, that there are substances which in the gaseous state dissociate or break up so as to yield a larger number of molecules, it appears a not unnatural assumption to make that when salts, acids, and bases are dissolved in water, they also dissociate; because, as we saw, their solutions behave as if the number of dissolved molecules were greater than that calculated from the molecular weight of the dissolved substance. If, however, we make this assumption, then the question at once arises, what then are the products of dissociation? If we take sodium chloride as an example, we shall ask: Into what substances does this dissociate when the salt is dissolved in water? Clearly, not into sodium and chlorine, for sodium is a metal which decomposes water with evolution of hydrogen, and chlorine is a gas which dissolves in water, imparting to it a characteristic odour and bleaching properties.

To obtain an answer to our question, we shall consider some other properties of the abnormal solutions. Take, first of all, the case of acids. If an acid is dissolved in water, you know that the solution has the power of reddening blue litmus. Thus, no matter whether we take HCl, HNO_3, H_2SO_4, H_2T (tartaric acid), this reaction is given. Now, the only element which these substances have in common is hydrogen, and we should therefore be tempted to say that the reddening of litmus is due to hydrogen. But you know that hydrogen gas does not redden litmus, and also you know that there are many substances containing hydrogen which, even when dissolved in water, do not possess the property, *e.g.*, cane sugar, $C_{12}H_{22}O_{11}$. Further, we find that acids redden litmus only when in solution; dry tartaric acid and pure

liquid hydrogen chloride do not possess the property. We must therefore conclude that the reddening of litmus is due not to hydrogen in the ordinary state, nor even to hydrogen in combination, but to a form of hydrogen which exists only in solution, *i.e.*, to some allotropic modification of hydrogen. Whenever that form of hydrogen is present in solution, we get the reddening of litmus; when it is absent, the solution does not give the reaction. For convenience, we shall designate this allotropic modification of hydrogen by $H^{\cdot}$.

What about the chlorine? You know that when silver nitrate is added to a solution of hydrochloric acid, a white precipitate of silver chloride is obtained. But this white precipitate is also given by NaCl, KCl, $BaCl_2$, etc. Now the only common element here is chlorine. But the precipitate cannot be due to the presence of ordinary chlorine, because a solution of chlorine has a characteristic smell, and also bleaches litmus paper. These properties are not possessed by a solution of sodium chloride. Nor is the white precipitate given by all compounds containing chlorine: neither chloroform, $CHCl_3$, nor carbon tetrachloride CCl_4 gives a precipitate. By the same reasoning as before, we see that the precipitate is given only in solutions, and must be due to some allotropic modification of chlorine which we shall represent by Cl'.

From all this, then, we can say that when hydrogen chloride is dissolved in water, there is formed $H^{\cdot}$ and Cl'; and these two parts behave quite independently, *i.e.*, each gives its own individual reactions, no matter what other substances may be present. But if this is so, then instead of the one molecule HCl we have now got the two molecules $H^{\cdot}$ and Cl'. and, therefore, the osmotic pressure should be twice as great as would ordinarily be expected. If we use very dilute solutions, this is found to be the case.

Some further insight into the nature of solutions can be obtained in another direction, viz., from the electrical behaviour of solutions. I have here a vessel containing distilled water. When I place in the water two platinum electrodes connected with a battery and a galvanometer, no indication

of a current is given. If I add cane sugar or alcohol to the water, there is still no current. If, however, I add a little hydrochloric acid, or sodium chloride, you see at once that the needle of the galvanometer is deflected, which shows that now a current is passing through the solution. In the same way other substances may be tried, and we should find that those substances which, when dissolved in water, yield conducting solutions, are exactly those substances which give solutions having an abnormally high osmotic pressure; whereas, those substances which give normal osmotic pressure do not yield conducting solutions. The two phenomena appear, therefore, to be connected.

When an electric current passes through a solution, even the most superficial observation teaches us that a liquid conductor differs from a metallic one. In the latter case, no apparent change may take place, but in the former there is a very obvious decomposition of the dissolved substance. In the case of a solution of copper sulphate, copper is deposited on one of the electrodes; in the case of sodium chloride, sodium is liberated at one of the electrodes, and then immediately decomposes the water with evolution of hydrogen and the formation of caustic soda, which gives an alkaline reaction; and chlorine is set free at the other electrode, and yields a solution having bleaching properties. Whenever a current passes through a conducting solution, therefore, there is a movement of ponderable particles through the liquid, some moving towards the one electrode, others towards the other electrode.

This conclusion was reached many years ago by Faraday, who called the moving particles which thus conveyed the electricity through the solution, *ions*; and this term is still employed.

Without attempting to trace the development which the ideas regarding conduction in solutions underwent during the middle decades of last century, I state at once the theory which is coupled with the name of Arrhenius, and which is the most satisfactory theory regarding the constitution of conducting solutions which has so far been propounded. This

theory states that when an electrolyte* is dissolved in water, the molecules undergo to a greater or less extent, dissociation into ions, or oppositely (electrically) charged particles, which lead an independent existence in the solution, have their specific properties and reactions, and behave, therefore, as independent molecules. When two electrodes are placed in a solution of an electrolyte and connected with a battery, then the positively charged electrode (called the *anode*) attracts the negatively charged ions (the *anions*); and the negatively charged electrode (the *cathode*) attracts the positively charged ions (the *cations*). These ions move in opposite directions through the solution, and give up their charges at the electrodes, and it is their movement through the solution that constitutes the electric current in the solution.

With regard to the nature of the different ions, we can say that when a salt ionises in solution, the metal part forms the cation, and the acid part the anion. Thus, for example, sodium chloride, NaCl, ionises into the positively charged cation Na^+, and the negatively charged anion Cl^-. (Instead of using the plus and minus sign to represent the charges, it is more convenient and more usual to employ a dot to represent a positive, and a dash to represent a negative charge. Thus, we should write the ions of sodium chloride, $Na^{\cdot}$ and Cl'). In the case of acids, hydrogen forms the cation, so that hydrochloric acid, for example, gives the ions $H^{\cdot}$ and Cl'; nitric acid, the ions $H^{\cdot}$ and NO_3'. It is indeed, to the presence of the hydrogen ion that the so-called acid properties are to be ascribed. In the case of alkalis, *e.g.*, sodium hydroxide, NaOH, the anion is formed by the hydroxyl group. Thus, NaOH ionises into $Na^{\cdot}$ and OH'. It is to the presence of this hydroxyl ion that the general properties of alkalis are due.

Even at the first glance it will be seen that this theory of ionisation, or electrolytic dissociation, enables us to co-ordinate a number of different phenomena, such as the chemical properties of electrolytes, their behaviour as regards osmotic pressure in solution, and their electrical behaviour.

* An electrolyte is a substance which, when dissolved, yields a conducting solution.

Cane sugar in solution, although it contains hydrogen, does not contain hydrogen ion, and therefore does not have an acid reaction. That it is not ionised is shown by the fact that it does not conduct electricity. Similarly, a solution of chloroform (in alcohol) does not conduct electricity; it is, therefore, not ionised, and so does not give a precipitate with silver nitrate.*

So far we have spoken only of binary electrolytes, *i.e.*, electrolytes which are capable of yielding only two ions. But a molecule of sodium sulphate, for example, is capable of yielding three ions, viz., two sodium ions and one sulphate ion; and there are other salts, again, capable of yielding more than three ions. Now it is evident that since a solution of sodium sulphate, to keep to that example, is, as a whole, neither positively nor negatively charged, the amount of electricity associated with one SO_4-ion must be equal to that associated with two Na-ions. But the amount of electricity associated with a gram-ion (weight of ion in grams) of sodium is 96580 coulombs, and as this is the smallest amount of electricity associated with the gram-ionic weight of any substance, it is taken as the unit charge. Hence, the symbol for sodium ion is written with only one plus sign or one dot. But since the SO_4-ion must carry twice as great a charge, we must write it with two minus signs, or with two dashes, thus—SO_4''. We can also have cations carrying more than one unit of charge; thus copper sulphate gives the ions $Cu^{\cdot\cdot}$ (one gram-ion, 63 gm., being associated with 2 × 96580 coulombs) and SO_4''. In general the number of unit charges which a gram-ion carries is given by the valency of the ion; thus we have the trivalent ions $Fe^{\cdot\cdot\cdot}$, $Al^{\cdot\cdot\cdot}$, etc., and the ion PO_4''' of phosphoric acid (H_3PO_4). This, now, allows us to understand Faraday's law of electrolysis, which states that when a current is passed through solutions of salts of different metals, the amounts of these set free at the electrodes are proportional to their atomic weights divided by the valency. Thus, the current which will liberate 1 gm. of

* It ought to be mentioned that the converse of this does not hold; immediate interaction between substances accompanied by precipitation *may* occur even when there is no appreciable conductivity and therefore no appreciable ionisation. These cases are, however, comparatively rare.

hydrogen, or 23 gm. of sodium, will deposit only $\frac{63}{2}$ gm. of copper. For we have seen that every 23 gm. of sodium as ion are associated with 96,580 coulombs of electricity; and if this amount is passed through a solution of a sodium salt, 23 gm. of sodium will be deposited. But every 63 gm. (1 gram-atom) of copper in the ionic state is associated with 2×96580 coulombs, and therefore if we pass only 96580 coulombs through the solution, only $\frac{63}{2}$ gm. of copper will be deposited.

Degree of Ionisation.—Although, according to the theory of Arrhenius, the molecules of salts are capable of breaking up into ions, it does not necessarily occur that all the molecules thus break up. It is therefore necessary to determine the degree of dissociation or ionisation, *i.e.*, the relative number of the molecules which yield ions. This, we shall learn, varies with varying conditions, more especially with varying concentration.

The first method which may be employed to determine the degree of ionisation is the cryoscopic. The depression of the freezing point enables us to state the number of independent individuals in the solution, *i.e.*, the number of undissociated molecules *plus* the ions. We have already learned that the isotonic coefficient gives the ratio of the observed to the calculated depression of the freezing point; or, since the depression of the freezing point is proportional to the number of dissolved molecules, the isotonic coefficient gives the ratio of the number of independently acting molecules to the number calculated from the ordinary molecular weight of the dissolved substance. Thus, for example, a solution of sodium chloride containing 0.20 gram-molecules per litre, gives a depression of the freezing point of 0.690°. But, normally, a solution containing 0.20 gram-molecules per litre should give a depression of only 0.370°. Therefore, the actual or effective number of gram-molecules per litre is $0.690/0.370 = 1{,}865$. From this we can calculate the extent to which the sodium chloride is ionised in the solution. Each molecule of NaCl is capable of giving two new molecules or ions. If we dissolve, say, 1 mole of sodium chloride,

then, in solution, the effective number of gram-molecules will be two, provided the ionisation is complete; and the depression of the freezing point would be twice as great as when no ionisation occurs. Suppose that only a certain fraction, x, of the NaCl molecules are ionised, then there would be $(1-x)$ gram-molecules of unionised NaCl, and $2x$ gram-molecules of ions. In all, therefore, there would be $1-x+2x=1+x$ gram-molecules (since an ion has the same effect as an ordinary molecule). Hence, $i=\frac{1+x}{1}$ or $x=i-1$. But, in the above example, $i=1.865$; therefore, $x=0.865$. Of the total number of molecules of sodium chloride dissolved, therefore, 0.865 of them undergo ionisation. Similarly, if we have a salt, say potassium sulphate, K_2SO_4, capable of giving three ions, then the effective number of gram-molecules is increased in the ratio of $1:(1-x)+3x$ or as $1:1+2x$. Hence, $x=\frac{i-1}{2}$. Or, in general, if the salt molecule can yield n ions, the degree of ionisation will be given by $x=\frac{i-1}{n-1}$. When $i=n$, then $x=1$, and the ionisation is complete.

Now, on determining the freezing points of solutions of different concentration, it is found that the value of i increases as the solution becomes more dilute, as is shown in the following table :—

TABLE 8.

CHANGE OF i WITH DILUTION, SOLUTIONS OF SODIUM CHLORIDE.

Molar concentration.	Depression (observed).	Depression (calculated).	i	x
0.200	0.690°	0.370°	1.865	0.865
0.171	0.592°	0.316°	1.871	0.871
0.169	0.590°	0.313°	1.887	0.887
0.150	0.539°	0.278°	1.942	0.942
0.127	0.464°	0.235°	1.974	0.974

For the physiologist, however, it is the calculation, not so much of the degree of ionisation as of the isotonic coefficient that is of importance. That is to say, if a salt solution of known concentration is given, it is important to be able to calculate the osmotic pressure of the solution. In order to do this, the value of x, which can be determined by

quite a different method (see later), can generally be obtained from tables, and then, by means of the equation previously given, $i = 1 + (n - 1)\,x$, the value of i can be calculated, and hence, also, the value of the osmotic pressure.

To take an example: In a solution of NaCl containing 0.50 mole per litre (approximately 2.9 per cent.), the degree of ionisation is 0.73. From this, since $n=2$, $i=1+0.73=1.73$.

Hence, the osmotic pressure of this solution will be 1.73 times the normal. But the normal osmotic pressure at 0° would be 11.2 atmospheres; therefore, the osmotic pressure of the above salt solution will be $11.2 \times 1.73 = 19.4$ atmospheres, and the depression of the freezing point instead of being 0.925°, will be $0.925 \times 1.73 = 1.600°$.

While cryoscopic measurements yield directly the effective concentration of a solution, *i.e.*, the sum of the concentrations of unionised molecules plus ions, and indirectly the concentration of the ions, the latter can be determined more easily by an electrical method. We may give the principle of this method without entering too much into detail.

By conductivity one means the reciprocal of the resistance, which is the factor directly measured. By *specific conductivity* is meant the conductivity of a cube of 1 cm. side; but since the whole of the solution does not take part in the conduction, it is better to compare the conductivity not of a centimetre cube of solution, but the conductivity of solutions containing equivalent amounts of dissolved substance between the electrodes. This is known as the *equivalent conductivity*.

Now, the connection between the specific and the equivalent conductivity is obtained in the following way. Suppose we have a rectangular vessel, the two opposite sides of which are of metal and 1 cm. apart. If we place 1 c.c. of solution in such a vessel, then the conductivity measured will, of course, be the specific conductivity. Further, suppose that there were 1 gm. equivalent of dissolved substance in the 1 c.c. of solution, then the conductivity measured would also be the equivalent conductivity. Now dilute the solution by pouring in distilled water, making the volume up to. say, 1000 c.c. or 1 litre. The conductivity of this solution will

now be 1000 times the specific conductivity, because there are now, so to speak, 1000 cubes of solution of 1 cm. side. But since we have still 1 gm.-equivalent of dissolved substance between the electrodes, the conductivity which is measured is also the equivalent conductivity; so that in this case the equivalent conductivity is 1000 times the specific conductivity. Or, in general, we can say, the equivalent conductivity of a solution is equal to the specific conductivity multiplied by the volume in cubic centimetres in which 1 gm-equivalent of the electrolyte is dissolved.

On carrying out the necessary measurements, it is found that the *equivalent* conductivity of all solutions of electrolytes increases with dilution. This can be shown very easily by means of the rectangular vessel already described. If we place in this cell a certain quantity of a solution of an electrolyte, *e.g.*, ammonium hydroxide, and connect the two electrodes with a battery, we observe that the needle of the galvanometer is deflected to a certain extent, indicating the passage of a certain current through the solution. If, now, I pour water into the cell so as to dilute the solution, you see that the galvanometer needle is deflected to a greater and greater extent, showing, therefore, that the current passing through the solution is becoming greater. Since the driving force (the electromotive force of the battery) remains unchanged, it follows that the resistance of the solution has diminished with dilution, or the conductivity has increased.

This increase in the conductivity must be due to one or other of two factors, or to both of them, viz., to an increase in the number of ions, or particles carrying the current, or to an increase in their velocity of movement. It has, however, been found that dilution has very little influence on the velocity of movement of the ions, and so we must conclude that the increase in the conductivity is due to an increase in the number of ions. We also obtained this result by means of cryoscopic measurements (Table 8).

But the increase in the number of ions cannot go on indefinitely; it must cease when all the molecules have become ionised. Hence, the equivalent conductivity is

found to increase with dilution only up to a certain point, beyond which dilution has no longer any effect; and there is therefore a certain maximum value of the equivalent conductivity, which depends on the electrolyte. This increase in the equivalent conductivity with dilution is shown very clearly by the following table :—

TABLE 9.

EQUIVALENT CONDUCTIVITIES AT 18°.

Dilution in litres.	KCl	$\frac{1}{2}K_2SO_4$	$\frac{1}{2}MgSO_4$
1	98.2	71.8	28.9
10	111.9	95.9	50.1
100	122.5	117.4	76.6
1000	127.6	129.0	100.2
2000	128.3	130.8	104.8
5000	129.1	132.7	108.7
10000	129.5	133.5	110.4

But we have already learned that the conductivity of a solution is practically proportional to the concentration of the ions. If we represent the equivalent conductivity of a solution at very great dilution (so-called infinite dilution) when all the electrolyte is ionised, by C_∞, and the equivalent conductivity at any other dilution, v litres, when only the fraction x of the electrolyte is ionised, by C_v, then it follows that $Cv = x\ C_\infty$, and therefore $x = \frac{C_v}{C_\infty}$. Hence, we can determine the degree of ionisation at any given dilution by measuring the equivalent conductivity at that dilution, and dividing it by the equivalent conductivity at infinite dilution when all the electrolyte is ionised.

With regard to the degree to which different electrolytes are ionised, it is found that, in general, all salts are largely ionised, but that in the case of acids and bases there are great differences, some acids and bases, *e.g.*, HCl and NaOH, being very largely ionised in solutions of moderate concentration, while others, *e.g.*, acetic acid and ammonium hydroxide, are only slightly ionised. This is seen from the following table, which applies to solutions containing 1 gm-equivalent in 2 litres.

TABLE 10.

	Degree of ionisation.		Degree of ionisation.
NaCl	0.74	HCl	0.85
KCl	0.79	H_2SO_4	0.53
NaAc	0 64	HAc	0.006
Na_2SO_4	0.54	NaOH	0.79
		NH_4OH	0.006

The halogen salts of mercury are among the more important exceptions to the rule that salts are largely ionised.

SOME APPLICATIONS OF THE IONIC THEORY.

As an effect due to the action of ions, we may again refer to the production of artificial parthenogenesis. The ova of chaetopterus, for example, undergo parthenogenic development under the influence of small quantities of potassium ion, *i.e.*, addition of any potassium salt causes the development of the eggs; but other salts, which do not yield potassium ion, are without influence. Similarly, the ova of the starfish can be caused to undergo parthenogenic development by the hydrogen ion—by the addition, therefore, of any acid—but not by potassium ion. Again, the ova of the amphitrite undergo parthenogenic development under the influence of calcium ion, but not under the influence of potassium or of hydrogen ion. Finally, it was found that the ions, $Mg^{\cdot\cdot}$, $Sr^{\cdot\cdot}$, $Li^{\cdot}$, $Na^{\cdot}$, $K^{\cdot}$, are without action on them.

A number of very interesting observations have also been made by Loeb and others on the effect of potassium and sodium salts in promoting the production of dwarf and giant embryoes. In presence of sodium chloride, for example, it was found that there was a tendency for more than one embryo to be formed from one ovum—the embryoes being then smaller than usual. In presence of potassium chloride, however, there is a tendency towards agglutination of ova, which then undergo development with the production of giant embryoes. This difference in the action of potassium and sodium ions is of considerable interest.

The chemotactic action of ions has also been observed very clearly in the attraction of the spermatozoa to the archegonia of the ferns. It was found by Pfeffer and by Buller that the negative ion of malic acid ($C_4H_4O_5^{\cdot\cdot}$) has the

greatest attractive power. Since this ion is given by any of the salts of malic acid, the same effect is observed, irrespective of the cation which is present, provided the concentration of the malate anion is the same. Owing to the difference in the degree of ionisation of the different salts, equivalent solutions will not necessarily have the same influence, so that it is necessary to take the degree of ionisation into account. Other ions were also found to have an attractive force, but the hydrogen ion apparently repels, so that in free malic acid the attractive influence of the malate anion is counteracted by the repulsive effect of the hydrogen ion.

Toxic Action of Ions.—One of the best illustrations of the influence of ions is found in the study of the disinfective and toxic action of ions, which is observed very clearly, and has been well investigated in the case of mercury salts. The experiments were carried out chiefly with mercuric chloride, bromide, and cyanide, the test being the poisonous action of equivalent solutions of these salts on the spores of the anthrax bacillus. From conductivity measurements, it is found that these salts are not ionised to any great extent; but the ionisation of the chloride is greater than that of the bromide, and this in turn is more ionised than the cyanide. In fact, the cyanide appears to be practically unionised. If, then, the toxic action of the above salts is due to the mercury ion ($Hg^{\cdot\cdot}$), it would be expected that the action of the chloride would be greater than that of the bromide, and that this would be more effective than the cyanide. This was found to be the case, as can be seen from the following table :—

TABLE 11.

Solution.	After treatment for 20 minutes there developed	After treatment for 85 minutes there developed
1 mole $HgCl_2$ in 64 lit	7 colonies	0 colonies
1 ,, $HgBr_2$ in 64 lit.	34 ,,	0 ,,
1 ,, $Hg(CN)_2$ in 16 lit.	∞ ,,	33 ,,

From this we see, in the first place, that the toxic action increases with the time during which the solutions are allowed to act on the spores; and, secondly, the toxic effect runs parallel with the degree of ionisation of the salts. This

shows that the toxic action depends chiefly on the concentration of the mercury ion, although it is not at all improbable that the chloride and bromide ions have also some, although comparatively slight, influence. The effect of the neutral molecules, also, appears to be very slight, if, indeed, they exercise any influence at all.

Similar results are obtained with the salts of silver, but as these are more highly ionised, the effect of the anion makes itself felt. Thus :—

TABLE 12.

Solution.	Number of colonies which developed after treatment for 60 minutes.
1 mole $AgNO_3$ in 20 lit.	27
1 ,, $AgClO_3$ in 20 lit.	42
1 ,, $AgClO_4$ in 20 lit.	219

Since the above salts are ionised to approximately the same extent, it would appear that the nitrate ion is more toxic than the chlorate and perchlorate ions.

The theory of ionisation, however, not only helps us to understand the action of the salts, but it also suggests methods of overcoming the toxic action. If this is due to some particular ion, then we should be able to diminish or to annul the action by diminishing the concentration of that ion. The first, most obvious way of doing this is to diminish the degree of ionisation of the salt.

Let us consider only the case of mercuric chloride or corrosive sublimate. This salt undergoes ionisation as expressed by the equation, $HgCl_2 = Hg^{\cdot\cdot} + 2Cl'$. At any given concentration and temperature, there is a certain condition of equilibrium between the unionised mercuric chloride and the ions $Hg^{\cdot\cdot}$ and Cl'. Now, we can diminish the degree of ionisation, and therefore the concentration of $Hg^{\cdot\cdot}$, by adding chloride ions, in accordance with what is known as the Law of Mass Action. As this is a very important law, we shall make a slight digression here in order to give a short account of it.

Law of Mass Action.—You know that a chemical reaction is generally represented in the form of an equation, *e.g.*,

$Zn + H_2SO_4 = ZnSO_4 + H_2$, meaning that if we allow 1 mole (65 gm.) of zinc to act on 1 mole (98 gm.) of sulphuric acid, there are produced 1 mole (161 gm.) of zinc sulphate, and 1 mole (2 gm.) of hydrogen. In this case the reaction takes place completely from left to right, *i.e.*, all the zinc is converted into zinc sulphate. But there are many reactions which do not take place completely as represented by the chemical equation, but which cease before all the reacting substances have been used up. The usual reaction which is quoted as an example of this is the action between acetic acid and alcohol. If these two substances are mixed together, there are formed ethyl acetate and water, as represented by the equation, $CH_3{\cdot}COOH + C_2H_5OH = CH_3{\cdot}COOC_2H_5 + H_2O$.

In this case, however, we should find that if we take equivalent quantities, say 1 mole, of the acid and alcohol, the reaction would not take place completely, *i.e.*, the acid and the alcohol would not entirely disappear, but only two-thirds of them; while one-third would remain unchanged, no matter how long they were left in contact. This is due to the fact that water acts on the ethyl acetate, converting it back again into acetic acid and alcohol. In other words, the reaction tends to be reversed according to the above equation read from right to left. We have therefore two opposed reactions taking place, and the consequence is the production of a condition of equilibrium between the acid and alcohol on the one side, and the ethyl acetate and water on the other. We have, therefore, what is known as a balanced reaction, and to represent this the usual sign of equality is replaced by two arrows, so that the interaction between acetic acid and alcohol should be written

$$CH_3{\cdot}COOH + C_2H_5{\cdot}OH \rightleftharpoons CH_3{\cdot}COOC_2H_5 + H_2O.$$

Now, in the case of all balanced reactions, the law of mass action states that the product of the concentrations (expressed in gram-molecules per litre) of the substances on the one side, divided by the product of the concentrations of the substances on the other side of the arrows, is equal to some definite, constant number (provided the temperature remains

unchanged). This law is expressed mathematically by the equation

$$\frac{C_a^{n_1} \times C_b^{n_2} \times \cdots}{C_x^{n_3} \times C_y^{n_4} \times \cdots} = \text{constant},$$

in which C_a, C_b, etc., represent the concentrations of the substances on the one side of the chemical equation, and C_x, C_y, etc., represent the concentrations of the substances on the other side of the equation. The indices are the number of molecules of the different substances reacting. In the case of the formation of ethyl acetate from acetic acid and alcohol, the indices are all unity, so that the condition of equilibrium is given by the expression :

$$\frac{C_{acid} \times C_{alcohol}}{C_{ester} \times C_{water}} = \text{constant}.$$

The value of the constant must, of course, be obtained by experiment; in the case just mentioned it is equal to $\frac{1}{4}$.

Now, it does not at all matter in what proportions we mix the four substances, acetic acid, ethyl alcohol, ethyl acetate and water; the same condition of equilibrium is always attained, viz., that represented by the immediately preceding equation. Suppose, then, that when equilibrium has been attained, a further quantity of acetic acid is added, we thereby increase the concentration of one of the components of the mixture; the product of concentrations in the numerator is thus increased, and, in order that the above equation shall remain true, the value of the denominator must also increase. That is to say, there must be a further combination of alcohol and acid to form ester and water. By adding sufficient acid, we can then cause all the alcohol to be converted into ester.

We can at once apply what we have just learned to the case of mercuric chloride, and the diminution of the degree of ionisation of this salt by addition of sodium chloride.

When mercuric chloride is dissolved in water, ionisation takes place to a limited extent, and an equilibrium is produced between the unionised mercuric chloride and the ions, as represented by the equation : $HgCl_2 \rightleftarrows Hg^{\cdot\cdot} + 2\,Cl'$.

According to the law of mass action, however, we can say that

$$\frac{\text{Conc}_{HgCl_2}}{\text{Conc}_{Hg^{\cdot\cdot}} \times \text{Conc.}^2_{Cl'}} = k.$$

in which k has a definite numerical value, at any given temperature, no matter how the concentrations of the unionised salt or of the ions may be altered. Hence, if we increase the concentration of the chloride ions by the addition of, say, sodium chloride (which yields the ions $Na^{\cdot}$ and Cl'), the result will be an increase in the concentration of the unionised mercuric chloride. In other words, a certain amount of the mercuric ions must combine with chloride ions to form unionised salt, so that, as a result, the concentration of the mercuric ions must diminish. It will also be evident that, in order to effect the diminution of concentration of mercuric ions, it is not necessary to add sodium chloride; any chloride capable of yielding the chloride ion will serve the purpose.

The diminution in the toxic power of mercuric chloride produced by the addition of sodium chloride is shown in the following table :—

TABLE 13.

16 litres of solution contained	After treatment for 6 minutes there developed
1 mole $HgCl_2$	8 colonies
1 ,, $HgCl_2$ + 1 mole NaCl	32 ,,
1 ,, $HgCl_2$ + 2 moles NaCl	124 ,,
1 ,, $HgCl_2$ + 4 ,, NaCl	382 ,,
1 ,, $HgCl_2$ + 10 ,, NaCl	1087 ,,

Whenever, therefore, the toxic action of a salt is due to the cation, we can diminish the toxicity by adding a non-toxic salt having the same anion.

But there is another way in which the concentration of an ion can be diminished, namely, by causing it to enter into combination, so as to form what is known as a complex ion. Thus, for example, the toxic action of silver salts can be reduced by the addition of sodium thiosulphate, $Na_2S_2O_3$. The reason of this is that the silver ion combines with the thiosulphate ion (S_2O_3'') to form the complex AgS_2O_3', which is non-toxic. In this way the toxic silver ions can be removed from the solution.

This formation of complex ions also plays a part in the reduction of the toxic action of mercuric chloride by addition of sodium chloride, as some of the mercury ions combine with the chloride ions to form the ion $HgCl_4''$ which is non-toxic.

From all that has been said, it will be evident that in estimating the toxic action of salt solutions, it is not enough to determine merely the total concentration of dissolved salt, but also the concentration of the ions. It must, however, be stated that the question is not in all cases so simple as it would appear from the foregoing to be; but complications are met with, such as influence of diffusibility, and others which have not all been satisfactorily cleared up.

The effect of acids and alkalis (*i.e.*, of the hydrogen and the hydroxyl ions) on the growth of seedlings has also been investigated, and the same general relationships found between the degree of ionisation and the degree of activity.

It has also been found that ions exercise an influence on the solubility of substances in water, *e.g.*, of phenol, carbon dioxide, nitrous oxide, etc. This is of interest as affording an explanation of the effect of addition of sodium chloride in increasing the toxicity of solutions of phenol (carbolic acid). This effect is shown by the following table, which gives the number of colonies which developed after treatment with different solutions.

TABLE 14.

Solution.	Duration of action on anthrax bacillus in days. 0	3	7	9	11	13	15	
3% Phenol	6300	1390	1260	950	810	530	560	530 col.
„ „ +1% NaCl	5720	1450	1320	360.	—	—	100	0 „
„ „ +8% NaCl	1940	150	50	0	—	—	—	— „

This behaviour is probably due to an alteration in the distribution of the phenol between the water and the cells (bacteria); addition of salts diminishing the concentration of the phenol in the water and increasing it in the cells. Other electrolytes give a similar result, but unionised salts appear to have comparatively little action.

(*To be continued.*)

PRACTICAL THERAPEUTICS.

INSOMNIA.

By ARTHUR FOXWELL, M.D., *Professor of Therapeutics in Birmingham University.*

IN the treatment of this disorder, especially its milder and more chronic forms, it seems to me that not enough use is made of those drugs which regulate the cerebral circulation, and too much of those upon the rationale of whose action we know nothing, and of those which depress the nerve centres directly.

Perhaps the physiologists are chiefly to blame for this lapse of ours, for they have taught us very little concerning this, the most important of all circulations. After much laborious work, Gulland and others (*Brit. Med. Journ.*, 1898, Vol. II., p. 781) have discovered the usual peri-vascular nerve plexuses on the cerebral vessels, but the *experimental* evidence of physiologists goes to show that these can have but little influence on the cerebral blood supply, and that this is dependent almost entirely upon the action of the general vaso-motor system.

Be this as it may, we know, clinically, that both high and low tension tend to insomnia. Experiments show that high tension in the aorta raises the intra-cranial pressure: at first the cerebral vessels expand, and the cerebro-spinal fluid is driven out; but this is soon accomplished, and, if the high aortic tension continue, the intra-cranial pressure—*i.e.*, the pressure in the capillaries and veins—rises: hence the outflow through the veins is increased and the cerebral circulation quickened. Two things are thus accomplished by a rise in aortic pressure—first, an increase in the amount of

cerebral blood, and, second, an increase in the velocity of its flow. Both these evidently make for increased activity of the brain cells, *i.e.*, to insomnia. Experimentally, this would seem to be a constant result of a rise in the aortic pressure, no matter how poisonous the circulating blood may be to the brain cell. That is to say, the brain does not seem to possess any effective special apparatus for directly controlling its blood supply; it can only do this indirectly through the centre in the medulla. Hence, its vasomotor nerve plexuses must have a much less powerful action than those of the kidneys, *e.g.*, on the other hand, it would be very unwise to suppose that they have no influence at all.

Aortic high pressure, then, increases cerebral activity. Gouty people have proverbially active intellects. But what we are accustomed to does not alter the even tenor of our lives (though we recognise that high-tension people are more prone to sleeplessness than others). It is a sudden change from the normal of each individual which disturbs him. It is the rise above our normal pressure which makes us wakeful; and any drug which will bring it back to the normal, be this high or low, will bring us sleep, perhaps not at once—the brain cell has to quieten down from its period of irritability—but assuredly in a day or two.

In everyday life the commonest cause of aortic high pressure is imperfect assimilation of food, which produces a reflex contraction of the splanchnic arteries, and so general high tension. The most generally useful regulators and stimulators of the chylopoietic system are rhubarb and calomel, and their exhibition will often bring sleep, though perhaps not the first nor yet the second day. Such a prescription as this is what I mean :—

Pulveris Rhei	gr. 1
Hydrargyri Subchloridi	gr. 1/15
Pulveris Zingiberis	gr. ¼
Extracti Hyoscyami ...	gr. ½

Fiat pilula una : mitte 24.

One to be taken four times a day after meals.

If it be imperative to obtain sleep the first night, a mild dose of a previously unsuccessful hypnotic will often act well.

On the other hand, we get sleeplessness from feebleness of circulation : the insomnia of anæmia and debility. A full dose of strychnine or a little cocaine, or even a cup of tea, I have found act well as a soporific under such circumstances. The quicklier they act, *e.g.*, subcutaneously, the better the result is likely to be.

There are other cases where the brain cells are irritable, erethic, too easily excited to activity. Very slight causes will now induce insomnia, and the best drugs to use are those which merely dull cerebral action, *e.g.*, a mild dose of bromide, or three to six grains of veronal, which latter I have found harmless and most efficacious.

Often this irritability is associated with debility : then strychnine should be added to the bromide; in such cases these two form a most efficient hypnotic, even where much larger doses of bromide given alone have failed.

REVIEWS.

Our Baby : for Mothers and Nurses. By Mrs. J. Langton Hewer. Ninth Edition, revised. Bristol : John Wright and Co. 1904.

This book, which is in its ninth edition and fortieth thousand, has evidently achieved popularity with those to whom it is addressed, and we may say at once that it deserves a great measure of success. Its aim is to give a popular account of things that should be known by mothers and nurses in order that they may rear healthy infants. The information given is generally sound, and nothing appears to have been overlooked, the various chapters of the book dealing with the care of the newly-born infant, clothes, food, exercise and sleep, development of the infant, hygiene of the nursery, moral training, and baby's troubles, accidents, illnesses, and medicines.

In the matter of clothes the author is somewhat conservative, and gives little shock to nursery tradition, although with regard to the first clothes for infants, proposals for garments more suitable than those in general use have been made, which we could wish she had endorsed. We regret to find her alluding to "the bodices" of flannel petticoats.

In a useful chapter, "How Big Ought Baby to Be?" we note with satisfaction that the importance of regular weighing is insisted on. On general training we have some very wise advice, and the careful attention to detail is well illustrated by such *dicta* as these :—"Celluloid toys should be avoided, as they are highly inflammable." "Do not be content with the negative, always suggest something positive." "Never, as punishment, deprive a child of its food or shut it up in the dark." "A mother should remember

that when a child has lost his self-control, it is useless to reason with him." "A young child should not constantly be played with or talked to."

The chapters on feeding give generally sound and safe directions. It is stated that a fair sample of human milk would give 2.4 per cent. of fat. The analysis is obviously Luff's, from Cheadle, but many analyses give higher fat percentage, and the proportion seems to us too low to be regarded as a model. We think it a mistake, too, in dealing with artificial foods, to mention particular proprietary articles: it is better to indicate the class of preparation, as, fully malted, partially malted, starchy, etc.

Although, we are told, "The medical chapters have been specially written for the book, and the whole has had the advantage of being revised by a London physician," it is here that we find most to cavil at. Too much is said about treatment. There is always the danger that the mother or nurse may regard what is described as what she may do on her own responsibility, instead of as what the doctor may order. The section on club-foot is an example of this excess, while the very next, on heart disease, illustrates the golden mean. The phrase, "A doctor will probably order," should not, in our opinion, be used: suppose he doesn't. The giving of brandy is somewhat too readily suggested. Nor can we agree that "Every mother of a family should possess" a clinical thermometer. *Scrofulous* is not a word to be used as synonymous with *tubercular*, as in "a scrofulous inflammation of the brain"; the term "influenza cold," too, were best abolished. The section on constipation is the weakest in the book. We are told first: "This is a trouble to which hand-fed babies are much more liable than breast-fed ones." Now, as Dr. Hutchison puts it: "Constipation is the vice of breast-fed babies." We are also told that "Some children habitually go two days without an action of the bowels, and are none the worse for it." We doubt their scathelessness. The principles of the drug treatment of constipation are evidently not apprehended by the author. In the chapter on "Medicines for Baby," all but the opening general remarks

would be best omitted. Aconite may be "a most useful drug," and bromide of potassium "of great service during teething"; Parrish's food may or may not be "a good pick-me-up for children over two years old"; but, certainly, such information is useless, possibly dangerous, for "mothers and nurses."

We regret that the author has not given more attention to composition. To say nothing of split infinitives, slovenly and slip-shod sentences are not rare, *e.g.*, "The milk should not be from one cow, but from a mixed herd, as the slightest ailment in the one cow would be far more likely to disagree with the child than if taken mixed with other milk." We cannot believe that under any circumstances a "child looks like a boiled lobster sprinkled with cayenne pepper": it may resemble one in colour. "Big curds of solid casein, waltzing round the stomach," is language which has gone beyond being homely, without being funny.

Although not perfect, this book gives sound instruction of the greatest value to mothers and nurses. We should be glad to see it in any nursery.

The Nutrition of the Infant. By RALPH VINCENT, M.D. Second Edition, revised and enlarged. London: Baillière, Tindall, and Cox. 1904.

DR. VINCENT tells us that with "frequent opportunities of testing the results of practically every method at all commonly used" in infant feeding, "there were many failures," and that under these circumstances he turned to the percentage method propounded by Dr. T. M. Rotch, of Boston. "This method was thoroughly tested by the author in numerous cases, with the most gratifying results to all concerned, and he cannot now pretend to be in any doubt as to the value of the milk laboratory in relation to infant feeding. Its use has converted the most unsatisfactory part of his practice into one most satisfactory and full of interest." His book, then, of 314 pages, is in praise of percentage feeding, and we cannot help thinking that in pursuit of this object it was unnecessary

to introduce chapters in which the pathology and symptoms of "Inanition—Malnutrition—Marasmus," "Rachitis," and "Scorbutus" are described in a manner not superior to that of existing and accessible accounts of those conditions, or to devote one to the "Normal Development and General Examination of the Infant," and another to a not very lucid account of "The Chemistry of Infantile Digestion." Space saved by omitting these might have been given to a more precise statement of the principles which should guide us in adopting particular percentages of fat, lactose, caseinogen and whey proteids in actual cases. We may be wrong, but the impression left on us is that the author in any case where an infant is not doing well, begins with a low fat and proteid (especially caseinogen) percentage, and cautiously works up to higher percentages, and we think it possible that the same thing might be done with the "simple" methods despised of our author.

We admire Dr. Vincent's earnestness and thoroughness in studying and expounding all the factors in the problems of breast-feeding and substitute-feeding of infants, and we are at one with him in many things, as when he says that "it is a matter of imperative importance that the disgraceful conditions of the general milk-supply of this country should be ended. . . . . Radical changes are required in everything concerned with the handling of the milk from the time it leaves the cow to the time it reaches the consumer." We also agree that "As systematic practices, boiling and sterilisation must be absolutely condemned," and with the unsparing condemnation of the "patent foods." But we cannot agree with Dr. Vincent as to the utter futility which he implies of all methods of modifying cow's milk to infant needs other than those of the milk laboratory To read this book, one would suppose that no infant had ever recovered from serious gastro-enteric trouble, or grown up without developing rickets or scurvy, unless fed by means of percentage prescriptions (or, of course, by the breast); but one knows that this is far from being the case.

We notice, amongst other points that have been the subject of controversy, that Dr. Vincent favours the feeding of a normal infant after the first twenty-four hours with a substitute food until its mother is able to nurse it, and suggests the following approximate composition : Fat, 2 per cent. ; lactose, 5.50 per cent. ; whey proteids, 0.50 per cent. ; caseinogen, 0.15 per cent. ; alkalinity, 5 per cent; ten feedings, each containing one ounce. He also condemns cane-sugar as in itself inimical to the infant, and insists on lactose as the only form of carbo-hydrate present in milk, and therefore the only form suitable for the infant. He condemns, too, preparations in which "peptonisation of the proteid materials has been resorted to," "since they directly encourage atrophy of the digestive glands."

On page 204 we are told that, "As a rule, the female infant, by reason of its greater intuition, learns to speak earlier than the male." It would be interesting to know exactly what this means.

It would be interesting, too, Dr. Vincent being a M.R.C.P., to have the opinion of the College of Physicians as a body on such phrases as "to at all approach," "to more or less provide," "the sour vomiting of curdled milk," "the effluvia baffles description," and "their colour changes from yellow to green, becoming watery, acid, and offensive, and containing masses of undigested food," all of which we cull from the pages of this book.

Elementary Lectures on Errors of Refraction and their Correction. By HAROLD B. GRIMSDALE, M.B., B.C., F.R.C.S. London : The Medical Times, Ltd. 1904.

THESE lectures are admirably adapted for the requirements of the student who is taking out clinical ophthalmology, and for the ophthalmic house surgeon. In the first chapter the subject of reflection and refraction of light is briefly, but lucidly, dealt with. The second chapter includes sections on physiological optics, acuity of vision, peripheral vision, vision testing, the use of mydriatics, and the choice of test types.

Chapter III. is taken up with an account of lenses and spectacle frames, and the value of glasses from a therapeutic point of view. Chapter IV. describes the theory and practical application of retinoscopy. The rest of the book is taken up with a detailed account of the various refractive and muscular errors and their correction by glasses. All the descriptions are clearly given, and the author's views on the principles of treatment in hypermetropia and myopia appear to us thoroughly sound. We cordially recommend this work as a safe guide to the study of errors of refraction and their correction.

ABSTRACTS.

THE SURGICAL TREATMENT OF FACIAL NEURALGIA.

By JOHN HUTCHINSON, JUNR.

The Surgical Treatment of Facial Neuralgia, by Jno. Hutchinson, junr., is a clear account of the complex and difficult subject of trigeminal neuralgia, and of the best forms of operation, as determined by the experience of twelve years, for its relief.

The surgeon is chiefly concerned with the question: "What cases of neuralgia are suited for operative treatment, and what are the best methods to employ?" The answer should depend upon an accurate and scientific classification based on the causes of neuralgia. Such a classification is, at present, impossible, because, for instance, of the gravest form of all, epileptiform or major neuralgia, the pathology and causation are unknown. For practical purposes the subject is classified as follows:—

1. Neuralgia minor, in which definite causes are present and furnish the appropriate indications for treatment. Certain known conditions also favour or induce the neuralgia in these cases.
   (*a*) Neuralgia due to anæmia, gout, malaria, or other abnormal conditions of the blood;
   (*b*) That due to a neuritis, *e.g.*, the neuralgia of herpes or tabes dorsalis;
   (*c*) The pain referred from a local cause, such as a carious tooth, an inflamed iris, a syphilitic node.

In these cases the pain is more or less continuous, or, if spasmodic, there are intervals of only comparative, and not complete, absence of pain.

2. Neuralgia Major, epileptiform neuralgia. Neither local cause nor favouring conditions can, as a rule, be assigned. The intermittent character of the pain is maintained from first to last, with shortening intervals. Any attempt of

the surgeon to remove some (supposed) peripheral exciting lesion is useless, and only operation on the intracranial portion of the fifth nerve (the gasserian ganglion) affords a complete cure.

When fully established, epileptiform neuralgia can, as a rule, be easily recognised and distinguished from the other forms. It is in the early stages that mistakes in diagnosis (and treatment) are apt to occur.

The importance of a correct appreciation of the various forms of neuralgia minor is emphasised by Mr. Hutchinson. A brief account is given of the special features of neuralgia due to ocular lesions (eye-strain, glaucoma, iritis, etc.), and herpes frontalis, to catarrhal or suppurative lesions in the air sinuses in the frontal, ethmoid and sphenoid bones; of the various forms of syphilitic cephalalgia, and the facial neuralgia of tabes dorsalis; and of that due to dental causes.

The treatment of minor neuralgia is indicated by the varying causes, but in a certain number of cases no cause can be found. For these, while it is certain that there is no curative treatment by drugs, empirical remedies may be of some use, and the following selection is given :—

Iodides of potassium and sodium, in cases having a syphilitic origin.

Quinine, the valerianate (5 grains), the hydro-bromide (2 to 5 grains), and the salicylate (5 to 10 grains).

Cannabis indica (one-fourth to one grain) is a dangerous remedy, but affords relief in some cases.

Gelsemium (5 to 15 minims of tincture) is stated by Sir Victor Horsley to have relieved true epileptiform neuralgia when given in poisonous doses.

Morphia. Its use in epileptiform is a grave blunder, or worse. It should never be used.

It is equaly certain that local treatment of neuralgia major is useless, but in some forms of neuralgia minor, sedative inunctions, the ethyl-chloride spray, electricity in its various forms, nerve-stretching, and the injection of osmic acid into the peripheral nerves, have afforded relief.

It is important to define epileptiform neuralgia (neuralgia

major or tic-douloureux) clearly, since in it alone are operations on the gasserian ganglion indicated. Its chief features are these :—

1. It is almost invariably unilateral—only two exceptions are recorded by Krause and Head.
2. It commences in the distribution of either the second or third divisions of the fifth nerve, and tends to involve both to the same extent.
3. The first (ophthalmic) division is involved comparatively rarely.
4. The attacks of pain are paroxysmal or spasmodic, and tend to steadily increase in severity.
5. In the intervals there is entire freedom from pain : a marked contrast to most cases of minor neuralgia. The intervals become pregressively briefer and briefer.
6. During each attack there is usually spasm of the facial muscles of the affected side.
7. No cause can, as a rule, be assigned for the onset of the disease. When once established, very slight stimuli induce the spasms.
8. The subjects of the disease, at its onset, are adults between the ages of thirty and fifty.
9. Its progress is one of steadily increasing severity, lasting an indefinite number of years. Spontaneous cure is almost unknown.
10. However long the duration of neuralgia, there is no disturbance of sensation (apart from operation).
11. Medical treatment, except increasing doses of morphia, has little or no effect. Operations on the peripheral branches of the fifth nerve may give temporary relief.
12. Partial or complete removal of the gasserian ganglion alone affords permanent cure.

The local distribution of the neuralgia in epileptiform cases is of much importance as an indication of the form the operation should take. In sixteen cases operated upon by Italian surgeons—

In four all three divisions of the fifth nerve were involved.

In two the second division of the fifth nerve was alone affected.

In one the third division of the fifth nerve was alone affected.

In nine both the second and third were concerned.

It is, therefore, obvious that in 75 per cent. there was no indication to interfere with the ophthalmic trunk, as removal of the lower part of the gasserian ganglion would suffice for a cure.

Mr. Hutchinson discusses the relation between epileptiform neuralgia and epilepsy, insanity, alcohol, gout, syphilis, and local causes. He dismisses the theory of local influences, and will not admit a connection between epileptiform neuralgia and any neurosis: "the disease stands by itself."

In considering the pathology of the condition, the idea of a true neuritis is improbable: the intervals of complete freedom from pain, the absence of motor paralysis and cutaneous anæsthesia, and of trophic changes in the eye or skin, is almost conclusive. Histological changes in the nerves are absent. Vascular degeneration from arteriosclerosis has been found in a few cases, but only in a small minority.

The gasserian ganglion has been repeatedly examined and found to show no pathological changes. Negative results have been recorded by Krause, Monari, Codivilla, Dr. Head, Dr. Renton, and Mr. Hutchinson, junr.

Tumours involving the ganglion are not uncommon: these cases afford clear evidence of the central origin of neuralgia of the fifth nerve, and in some instances the pain closely resembles that of epileptiform neuralgia. But there is, almost always, evidence of pressure on nerves, the carotid artery, or the cavernous sinus, with marked anæsthesia, ophthalmoplegia, or proptosis.

When once epileptiform neuralgia is well established, the right treatment consists in operation. The exact form this should take must be now considered. In the first place, "hysterical" neuralgia, simulating the true epileptiform condition, must be excluded. Such cases have been subjected to operation, but with uniformly unsuccessful results.

Should operation be limited to the division of the fifth nerve, which is alone involved? In many cases it happens that the pain is limited to the inferior dental and infra-

orbital nerves, that is, to certain branches of the main divisions: it seems reasonable for operative measures to be applied to the division or branch affected only.

In Trousseau's time, *neurotomy* or *nerve-stretching* were advocated, but of these procedures Trousseau says: "Even now, after more than thirty-six years of practice, I have never known it to be cured in a single case radically."

Billroth employed *resection of nerves*, as near to the base of the skull as possible. Better results were obtained, the neuralgia being entirely in abeyance for a few years in some cases, to return then in aggravated intensity and widened area. Bilbroth had never met with a lasting cure after a peripheral operation, although he had operated on over thirty patients with trigeminal neuralgia.

The patient with epileptiform neuralgia involving more than one division of the fifth nerve has these alternatives before him—the morphia habit, suicide, or death from exhaustion. Peripheral operations afford him only temporary relief, and each recurrence is usually worse than the last. Excision of the gasserian ganglion is alone certain to be followed by complete and permanent cure. In a case quoted, a patient during fifteen years underwent repeated minor operations:—(1) the teeth of the left side of the mandible were removed; (2) stretching the inferior dental nerve was repeatedly performed during a period of three years; (3) neurectomy of the same nerve was carried out, but after eight years further suffering; (4) Meckel's ganglion was excised. Four months later he took to morphia to allay the pain. Finally, fifteen years after the onset of his symptoms, the gasserian ganglion was removed. He has been free from neuralgia for seven years now.

A patient with the disease strictly confined to a particular nerve—the inferior dental, for instance—will not consent to the major operation unless more limited interference has failed. The extra-cranial operations are:—

1. Neurectomy of the inferior dental nerve, and of
2. The superior maxillary division.

I.—The best method of performing the former is by trephining through the outer part of the ascending ramus of the

lower jaw, at a point determined by the intersection of two lines, one drawn upwards from the angle perpendicular to the lower border of the jaw, the other a continuation backwards of the alveolar margin. The groove containing the inferior dental nerve and vessels is opened by the trephine, and as much of the nerve is resected—or torn out—as possible. The operation is easy and leaves no deformity.

II. *Operations on the Superior Maxillary Nerve.*—Poirier's method is condemned as not practical. Carnochan's operation (trephining the antrum of Highmore to reach the pterygo-maxillary fossa) is very difficult, does not certainly remove the palatine branches, and is not in favour. Resection of the outer wall of the orbit by Mugnai's method has no advantages and many drawbacks. Storr's operation is recommended. It consists, briefly, in following the infra-orbital nerve back along the floor of the orbit to the pterygo-maxillary fossa through an incision along the lower orbital margin: the scar is inconspicuous, and very little bone is removed. The nearer to the gasserian ganglion that resection can be carried out, the less will be the risk of recurrence of neuralgia in cases in which it is confined to the distribution of one of the main divisions of the fifth nerve.

III. *Intra-cranial Resection of the Superior Maxillary Nerve.*—This operation follows the main lines of the Hartley-Krause method of removal of the gasserian ganglion. The cranial cavity is entered through a trephine aperture in the temporal fossa, the dura mater and tempero-sphenoidal lobe are pushed upwards, and the foramen rotundum is sought for in front of (and without interfering with) the middle meningeal artery. The nerve is about half an inch in length in its intra-cranial course, and this portion is completely removed.

Mr. Hutchinson discusses the various methods that can be employed, and sums up as follows:—

"If the neuralgia is limited to the infra-orbital branches, resection of the nerve by following back the canal in the orbital floor may be tried. If the neuralgia concerns also the palatine branches, intra-cranial resection of the superior maxillary trunk should be carried out. If the inferior dental nerve be alone affected, it should be resected through a

trephine aperture in the outer table of the lower jaw. When the neuralgia concerns several branches of the inferior maxillary division (*e.g.*, the inferior dental; auriculo-temporal), intra-cranial resection of the trunk and adjacent part of the gasserian ganglion is indicated. For all other cases, those in which the neuralgia has already invaded two of the main divisions of the fifth nerve, the major operation on the ganglion should be carried out as affording the only hope of permanent cure."

Prof. Wm. Rose was the pioneer in the surgery of the gasserian ganglion. In 1890 he performed the first operation, attacking the root of the fifth nerve by the pterygoid route: an extremely difficult procedure that he has since abandoned.

The best operation is that devised and carried out independently by Dr. Hartley, of New York, and Prof. Krause, of Altona, in 1892, and which is generally known as the Hartley-Krause method. It consists in gaining access to the ganglion through the temporal fossa, the floor of which is removed as far inwards as the infra-temporal crest; the middle meningeal artery is ligatured and divided at the foramen spinosum, and the second and third divisions exposed and traced to the ganglion; this is then freed from the dura mater and either partially or in whole removed. The ophthalmic division was also divided. The original operation has been, to some extent, modified, the most important change in detail being the preservation, in cases in which the ophthalmic division is not involved in the trigeminal neuralgia, of this portion of the fifth nerve. Without describing the operation minutely, its important features deserve some attention:—

(*a*) *Should the operation be done in one or two stages?*—The long duration of the operation and the inevitable hæmorrhage may necessitate postponement of the completion of the operation, but whenever possible it should be completed at one sitting. Postponement increases the liability to sepsis, and to shock from two operations and the double anæsthetic. Plugging the wound cavity is attended with special risk of sepsis and injury to the brain.

(*b*) *The section of the skull.*—As little bone as possible should be removed : section of the zygoma is an unnecessary complication. The amount of bone in the temporal fossa removed varies considerably. Cushing and Poirier use a method which is not unlike that adopted by Rose, and has certainly no advantages over the Hartley-Krause operation.

(*c*) *The osteo-plastic method.*—The advantages of replacing the bone are doubtful. The aperture made by trephining is soon closed up largely or entirely by bone in the ordinary method. Replaced bone may not survive, and necrosis is a dangerous complication.

(*d*) *The Meningeal Artery.*—Krause recommends its division between two ligatures in every case. Occasionally the artery does not interfere with the treatment of the ganglion, and it may be left untouched. Should hæmorrhage from this source be troublesome, the foramen may be plugged with a bone point, or with wax.

(*e*) *Plugging the Foramina Rotundum and Ovale.*—Abbe has suggested the interposition of rubber between the dura mater and these foramina, to prevent re-union between the nerves and the ganglion after simple section. But regeneration of the divided branches after section (*i.e.*, the return of sensation in the cheek and palate) has never been known to occur, so that Dr. Abbe is providing against an imaginary risk.

(*f*) *Division of Sensory Root Alone.*—The motor root of the fifth nerve blends with the lower division of the ganglion ; section of the sensory root above the ganglion will preserve intact the muscles of mastication. Such a procedure is, however, extremely difficult and not altogether necessary, since the one-sided paralysis of the masticatory muscles causes very little inconvenience.

(*g*) *Ligature of the External Carotid Artery.*—As might be expected from the freedom of the collateral circulation, attempts to diminish hæmorrhage by ligature of the external carotid artery are of no use : no apparent effect is produced by doing so. Keeping the patient in an upright, sitting posture is far more efficient in restraining hæmorrhage.

The *Results* and *Complications* of successful removal of the gasserian ganglion deserve consideration. In the first place, the Hartley-Krause method leaves little disfigurement beyond some flattening due to atrophy of the temporal muscle : the scar is usually hidden by the scalp.

Secondly, the amount of cutaneous anæsthesia depends upon whether partial or complete removal of the ganglion has been effected. If the ophthalmic division has not been spared, the skin will be anæsthetic from the chin to high up on the forehead, and from the middle line to the temporal fossa. The ear and the masseteric region derive their nerve-supply from cervical nerves. If the ophthalmic division has been left intact, the important advantage gained is the preservation of sensation of the cornea and conjunctiva : the upper lid, with the greater part of the nose and the forehead, remain sensitive.

Thirdly, as regards the mucous membrane of the mouth and nose. The inner surface of the lips, the cheeks, gums, hard and soft palate are quite insensitive. The anterior two-thirds of the tongue is partially anæsthetic. Sensation in the pharyngeal vault and in the Eustachian tube is much impaired. The nasal cavity is callous to touch. Although the "gustatory nerve" is paralysed, yet the sense of taste of the tongue is not greatly affected. The glosso-pharyngeal nerve supplies the hinder third of the tongue, and the chorda-tympani (probably) its anterior portion. Cushing comes to this conclusion : "That the perception of taste is unaffected on the posterior portion of the tongue, and never permanently or completely lost on its anterior two-thirds after removal of the gasserian ganglion."

After complete removal of the ganglion, a most unfortunate complication may, sooner or later, ensue. This is the occurrence of neuro-paralytic keratitis, leading to the loss of the eye. That the danger is a real one is emphasised by Mr. Hutchinson, who has collected ten cases from the literature.

What is the mortality of the operation?

In Krause's thirty-six cases, the operation mortality was 16 per cent. Mr. Hutchinson has had eight cases, Lexer

eleven, and Sir Victor Horsley one hundred and twenty. Of these 140 cases of the Hartley-Krause operation, six died as the result of the operation—a mortality of only 4 per cent. Keen, Tiffany, and others record a mortality of 20 per cent. The main risks of the operation are shock, hæmorrhage, and sepsis.

Mr. Hutchinson recognises that, in certain cases, operation on the gasserian ganglion is to some extent a failure: there is no reason why neuralgia should not occur on the opposite side of the head, for instance. But those cases in which recurrence of the neuralgia on the same side has been observed are open to two lines of criticism. The patient may have been neurotic or hysterical, or the cause of the neuralgia cerebral, and instances of this class are quoted by Krause; or the ganglion has not been removed, owing to an inadequate operation, as proved by Mr. Hutchinson in one of his cases. The test of removal of the ganglion is, of course, the occurrence of anæsthesia of the skin of the face.

"The difficulties and drawbacks of the operation," says Mr. Hutchinson, "have been fully discussed, since it was only fair to do so. But, in conclusion, it may be pointed out that few procedures in the whole range of surgery are so successful as excision of the ganglion for true epileptiform neuralgia. With the improved methods of operating and the proper selection of cases, the risk to life is very small, and the prospect of permanent cure is great."

We cannot but concur in this expression of opinion. The disease is one of the most terrible that can affect a human being, producing an agony of suffering greater and more prolonged, probably, than any other, and offering less hope of alleviation. Suicide, death from exhaustion, or an existence rendered possible only by morphia, are the only issues for the unfortunate sufferer, unless he submits to an operation, formidable it is true, but from which he may hope to emerge in at least eighty cases out of a hundred free for ever from the appalling grip of pain which, fitfully at first, but almost unceasingly later, had so seized and shaken his being that a further hold on reason, or on life itself, seemed impossible.

A. W. NUTHALL

INGLEBY LECTURES.

University of Birmingham.

MENTALLY DEFECTIVE CHILDREN.

By JAMES KERR, M.A., M.D.

LECTURE II.—PRACTICAL POINTS.

WE have already dealt with some of the theoretical aspects of mental defect. To-day we must deal with practical questions on the broadest lines possible.

The first thing which suggests itself is how very little we know of the evolution of the first years of life, or of the order of appearance of the different faculties. It is not yet possible to draw up any definite scheme of what a child's faculties should amount to at different ages, and in the case of abnormal children and their parents variations appear to be very great. The expert can, however, often diagnose imbecility or idiocy at early ages. As a rule, we are not asked at such early ages for any positive diagnosis except as to blindness or deafness, and a child who does not fix with its eyes, or take any notice of a bright light brought before it by the age of three months, is either practically blind or imbecile. So, too, deafness, although in the feeble-minded its positive diagnosis is sometimes very difficult, is important to be differentiated from feeble-mindedness, as it is necessary to catch the congenital deaf mute as early as diagnosis is possible. In other cases of feeble-mindedness, the school doctor has much easier duties, as he is unlikely to see a child before the age of three, and will scarcely ever be asked for an opinion on one under the age of five. For educational purposes, the diagnosis of these cases depends in the first instance on the teacher or parent.

Either the child is not sent to school, when the school attendance authorities hunt it up; or it is sent to school, and after a time the teacher finds that special attention has to be given, with little or no result, and finally in London submits the child's name to the medical officer as a candidate for admission to a special class.

A considerable proportion of cases remain unsubmitted by the teachers. Until the recent Education Act, Voluntary Schools were great offenders in this respect. The best way to detect these cases until general medical inspection is established would be to insist on a satisfactory account being given of every child who remains in Standard I. after the age of eight years.

A number of parents will refuse to submit their children for examination, and it may be necessary to put into force the compulsory clause of the Act. This has to be done with the greatest consideration, as it is not uncommon for the friends of a mentally-defective child, even with a defect amounting almost to imbecility, to regard the child as a genius, particularly in those most hopeless for improvement, where the child is pert and loquacious, and wanting in the restraint and control which is common in intelligent children in the presence of elders or strangers.

Abroad, the teacher and school inspector alone decide finally as to the educational treatment of the child. In England this is wisely left to the medical officer. The child has to be examined by the medical officer, and this should be a very serious and formal function. There should be present—

(1) The parent or guardian of the child;
(2) The teacher who has had charge of it;
(3) The child itself.

The points which the teacher can help most with are—

(1) As to the child's obedience and behaviour, especially as regards cruelty or temper.
(2) As to its attention and concentration.
(3) As to its memory for the various items of school work.

The parents can often give useful information, too, as to personal history, habits—cruelty, thieving, lying, setting fire to things— and can be led on to family history.

The child itself is the most important evidence—its general aspect—mouth-breathing should always be noted if present. The various stigmata which have been described should be looked for.

Most children are shy, but certain defectives are quite unabashed in their behaviour; some are very confidential, and others smile or grin; there is a failure to realise their position which, when noticed, is good evidence of mental defect. Some come into the room and walk all round it, walk sideways or backwards into the room, or they point to particular things or make curious movements, but this gesture expression generally belongs to those bordering on imbecility.

Others have a curious staring expression, and it is always useful to note the eyes and eye movements; good fixation and following a moving object with the eyes, without moving the head, is a hopeful sign; but poor eye movements, the head being turned towards the moving object, is exceedingly common with mental defect. A want of fixation, or inability to keep it up, is, on the other hand, a very bad sign as regards intelligence. Squint is common, but of little importance; nystagmus, when present, suggests actual ocular or brain lesion of a coarse nature.

It is as well to speak to the child, to notice its hearing. Ask it gently, "What is your name?" "How old are you?" Most children, when quietly asked, will permit their arms and shoulders to be handled, whereby an estimate of their real nutritional condition can easily be made.

A few further questions: Show me your hands? Which is your left hand? How many fingers have you? What is that word? Can you write your name? What is it that cries "meiou"? Can you write down its name—cat? How do you spell it? Coloured beads. Such questions soon enable an idea of the child's faculties to be formed, but he will be a venturesome man who risks any prognosis as to the future school prospects of a child presenting simple amentia under the age of seven years.

The doctor sometimes has to make a judgment on general impressions, but he should not rely too much on this, and should endeavour to avoid it as much as possible. General impression is not safe. The layman is often deceived by the good-looking, pleasant child, which is more generally unresponsive to education than one of ungainly and objectionable appearance.

The medical certificate required is as to whether a child, not merely backward or dull, is mentally defective. The merely backward or dull child is normal or nearly normal in its general nervous relations, but backward in their expression, whilst the mentally-defective child is abnormal in some respects. There is irregularity in the mental development which should be looked for and detected if possible. The teacher's statements may often be a guide as to what to look for, but some qualities may be expected to be normal, others defective.

In all cases the doctor should make notes at the time, whilst the child is in front of him. He should be clear as to facts communicated to him, and as to his actual observations as regards the child's appearance, behaviour, and response, and be prepared to definitely support his judgment in Court if necessary.

The certificate of a medical officer recognised by the Board of Education, to the effect that a child is mentally defective for educational purposes, is, according to the Act, all the evidence of mental defect legally required.

Some of the cases, after such certification, will not be sent to the special classes. In no case should further attendance at an elementary school be permitted. If, however, the parent sends the child to some private school, so long as attendance is regular it will probably be inadvisable to interfere. In other cases the friends object, and sometimes submit medical certificates to contest the legal certificate, and magistrates occasionally go the length of constituting themselves judges of whether a child is mentally defective or not, instead of accepting the certificate which the law has authorised. This adds to the difficulties which have to be

met by the authorities on whom is laid the responsibility for the education of these defectives.

Of the children thus seen, it is very difficult to present a satisfactory classification. Theoretically we have seen that there are (1) cases of defect from normal, due to physiological variation; (2) cases due to pathological causes. It is not, however, yet possible to classify all cases under either of these heads, and we have to fall back on a rough empirical classification into certain clinical groups.

With congenital cases we have the numerous imperfections in development which have been described as stigmata of degeneration. Congenital cataract is often left untouched by the surgeon because he feels certain that the brain behind the retina is imperfect. Epicanthus is frequent: the highly-arched palate, unsymmetrical head, a frequent want of volume about the frontal region which gives a somewhat hemispherical shape to the forehead, irregularities about the ears, huge and protruding auricles, incurved little fingers, webbing, supernumerary, and so forth, are all stigmata which are known to occur more frequently in the congenitally feeble-minded than in mentally-normal children.

The majority of cases present *simple amentia*. When this is present in marked degree, their behaviour in school reminds one of the condition of the decerebralised frog: they sit, taking little notice, and appear to seldom act spontaneously; every action has to be elicited. They will do things when told, and can do them, but remain in pretty much the condition which has been described in certain tumours of the frontal and præ-frontal region of the brain. If asked to hold up a hand, or to put out the tongue, it is held up or out as the case may be till the order is given to put it down or in. They sometimes do comparatively well later on in school life, and occasionally surprise one with their acquaintance with certain limited subjects in which they are interested, as, say, horses or 'buses, or their fathers' trade.

Beyond the stigmata referred to, marked defects of a physical nature are absent in these children: occasionally they have what has been variously described as a bullet-headed, bull-dog, or prize-fighter look about them, but

nothing very definite or capable of description, and in some cases seem to be quite lively and active when out of school. Most generally, however, they are loafers, and appear neither to know how nor to feel the want to amuse themselves.

Some of the children in this group the teachers call "smilers," from their always appearing happy and smiling; they may be happy, but, as a rule, are also hopeless educationally.

The most characteristic group, though few compared with the last group presenting simple mental defect, is the *Mongol* type, with fine textured hair and skin, almond shaped, up and outward sloping palpebral openings for eyes, small round heads, and a thick and fissured tongue. This is a fairly common type in London. Varying in all degrees, but whilst imitative, they are generally not very educable. These children are frequently the last of a large family, and mostly born after their mother's fortieth birthday. *Cretinous children* are sometimes mistaken for them, but the cretin has a dry, harsh, yellowish skin, with hard, wiry, coarse hair, having a characteristic face, and very placid, with thick spade-like hands. They are commoner in the North of England than in London. The first I saw was an odd-looking child in a class of six-year-olds in the infant school. On asking how old she was, the teacher said twenty-two last birthday. Under thyroid treatment, even at that age she grew four inches in less than a year, but was lost sight of. The next was like an infant of less than a year old in accomplishments, although she was over seven. She passed some time in the children's ward of an infirmary, but ultimately came into the special class, and in five years appeared normal and almost fit for the ordinary school. It is important to catch these children before school days to begin thyroid treatment, as otherwise they get very dull mentally.

The cachectic appearance of certain of the strumous type, and more rarely of children with typical congenital syphilis, has led to their being occasionally taken for cretins, but the hair alone should be a sufficient means of diagnosis in most cases.

The next group are *microcephalic children*, and this is a very indeterminate class. Although it has been stated as having been mathematically demonstrated that the size of the cranium has no correlation to mental capacity, we still consider a head circumference of less than eighteen inches as microcephalic. At eighteen months old the circumference should amount to this, increasing another two inches by five years of age, the full-grown head averaging a trifle over twenty two inches.

These microcephalic cases have a rather characteristic shape of head, somewhat conical and pointed towards the vertex. There is not only general under-development of the brain, but the tracts of the spinal cord are said to be poorly developed, and such individuals have motor powers and defective gait corresponding to their mental condition. It tends to run in the family, so that frequently other members of the family, brothers or sisters, are either themselves microcephalic or mentally defective.

A group is also made of the large-headed children who have shown *hydrocephalic conditions*. The thin globular cranium, with the highly-arched eyebrows and the eyes with staring expression lying apparently low in the widely-stretched orbits, forms a characteristic appearance in marked cases. The child is not necessarily idiotic, although sometimes its brain must be a mere vesicle. A child of eleven years seen recently, whose cranial circumference was 28½ inches, although his body and limbs appeared like those of an infant one and a half years old, could not sit up, and was practically blind, yet he talked to me with great pertness and used the most idiomatic slang. Some of these children in institutions are the funny boys who amuse the other patients, and it is to be remembered that slight degrees of this condition in childhood have not hindered high intellectual powers. It is said to have existed in the lately-deceased Menzel, leader of German art; in Sir Isaac Newton, and in Helmholz. Rickets also is associated with the production of a large square head in some defective children, who often give a history of fits.

A more hopeless group of heterogeneous nature and difficult of analysis by they time they come up to the school doctor are those presenting *paralytic symptoms*. Congenital, possibly even intra-uterine, causes contribute to the spastic-paraplegia which is not uncommon. Birth palsies and also infantile hemiplegia produce all degrees of paresis, athetosis, and mental defects, the amount of paresis having little relation to the mental defect. The ordinary infantile palsy is seen often in candidates for cripple schools, but has no relation to mental deficiency. It is noteworthy that aphasia, even with right-sided paresis of muscles, is practically unknown.

Some of these paralytic cases where paresis can scarcely be detected are allied to the cases grouped as Eclamptic, where illness with convulsions which has lasted only a day or two has left behind uncommon mental or physical conditions. These acute illnesses are not always of the same nature. Total deafness has been mentioned as following what was probably correctly called mumps in a boy of five years, who ultimately turned out also mentally defective.

Two or three anomalous cases have been ascribed possibly to cerebro-spinal meningitis. In three cases of deafness the meningitic invasion of the labyrinth, described first as a symptom complex by Voltolini, has been clearly described by parents, but some cases appear to be simply convulsions not repeated, leaving permanent troubles, as, for instance, in a boy of three years, permanent paralysis of the right facial nerve to emotional movements, but not to voluntary, followed two fits in one afternoon, with no other apparent illness, and robust health for several years after.

Some of these eclamptic attacks are probably epileptic in nature, an epileptic family history being a strong point towards suspecting this; and in cases where epilepsy has become established about the second dentition, or puberty, such history of isolated fits in infancy is often obtained.

With *epileptic feeble-mindedness* we have all grades, and although the epilepsy may be a symptom instead of a cause, here again its existence is generally held to be sufficient

explanation of the mental condition. Epilepsy need only be taken into account with feeble-minded as with other persons in regard to the frequency and severity of the fits and their results. Colony treatment is the rational indication when this symptom is present.

There are some cases of onset of mental weakness with development which appear to be due to family causes. In the case of a typical family of ten children, the four girls grew up healthy, the four boys who survived infancy became mentally degenerate about six years old, were returned as insane at seven years, and died in the course of a year or two—school getting the blame for affecting these boys.

We must not stay over these empirical descriptions of types, which everyone must learn for himself.

The child, having been certified as mentally defective, is approved for admission to a special school.

The school, as conducted in compliance with the Elementary Education (Defective and Epileptic Children) Act of 1899, only receives children when thus certified by a medical officer approved by the Board of Education.

The first aim for the child's sake should be to remove as far as possible all marked characteristics of defect. The teacher should therefore catalogue the child's accomplishments carefully, and also note particularly the things in which he falls short of normal. Indeed, in relation to normal children, it would be useful if we had a catalogue not only of the things that they can do at each age, but also of the things which they cannot do, say, at four which will be done at five, and at five which will be done by six.

Our aims in such classes are very simple. We have referred to obstacles to education which may require treatment, adenoids in a very large number of cases. If a child is a mouth-breather, and habitually snores at night, it requires operation. In spite of the medical opinion so often quoted that it must sometimes be true to the effect that the child will grow out of this safely, so it will, but probably with damaged hearing and all the risks meanwhile of dying from otitis as a complication of some of the acute diseases of childhood. At present operation is not always practicable, and

the child often requires protection from the ignorance of its parents—neglect and opposition to medical advice being the rule with the friends of the mentally defective. Further, an occasional unexpected amount of improvement results from operation, even in the apparently mentally defective.

Relaxed, nerveless attitudes and slouching gait want straightening up, and good attitudes and sharp response in drill should be elicited. Self-confidence, too, in relation to locomotion—they want to be taught to toe a line correctly, to walk a plank or to jump off a chair fearlessly. The training of eye movements, to which Warner first referred, seems to help attention. Articulation is poor in the majority; bad in at least one-third of the cases when first seen. In this respect, attention from even comparatively untrained teachers soon effects considerable improvement.

Course manual employments and attempts at drawing on wall boards with chalk, when the memory or imagination has to be used, seems one of the most educational tasks in indirectly eliciting function from intellectual areas of the brain. These should be sufficient for the first three months' work in the special school.

There is still an excessive straining after literary attainments—almost waste of time and teachers' salaries. At the end of six months in the special class, it ought to be possible to decide which children are worth teaching reading and writing, and for the rest these subjects should be dropped as such for manual work, drawing, and oral teaching, as most of these children forget their literary work within a few weeks of leaving school.

The tendency—and it is not entirely good—is for the same teacher to have the same child for most of its school life. Where possible, the teacher should change every six months or so, to give the child the chance of getting out of grooves and getting fresh stimulus from another way of looking at things. The authorities who require a responsible teacher to each school for the whole year would prevent this being accomplished in most districts.

The development of habit is one of the most useful parts of special class work. Habits which a normal child acquires naturally and spontaneously have often to be taught carefully to the mentally defective, and self-control is all-important.

A class that is given to giggling or shifting the feet about much is obviously in want of better teaching. Self-control in each child is the best indication of good work by the teacher, and it is a pleased self-control, not the apprehensive restraint with furtive glances and furrowed brows that one meets with in the pupils of a martinet.

At the same time, each child fit to be retained in a special class ought by the end of the six months in school to be able to tell at least his name and address clearly and in a distinct and comprehensible manner, and should be able to write or print his full name in good large letters with chalk on the blackboard. These would be fair examination tests anywhere.

The boys and girls attend the same classes, but after the age of twelve years the boys should be collected to some centre for heavier muscular work, and under the control of men.

The law gives power to retain these children until sixteen years of age. Experience has shown that, unless future provision is made for care later in life, retention till sixteen is a waste. Four-fifths of the children appear to have reached their mental limit for schooling before fourteen, and would be better to be roughing it elsewhere if they have to mix in public life in the future.

In London, in attempts to make provision for every possible class of child, we have to encounter many troublesome problems. A curious clinic gathers at the Medical Department every Friday morning, consisting of cases which present problems of deafness, blindness, mental or physical defects in all combinations, which have not been able to be completely examined, or where a final decision has been deferred at the ordinary medical examination; and an educational *modus vivendi* is arranged in a kind of consultation of parents, school superintendents, and medical officer.

Every county council should arrange to have provision for these cases with complications. Most require institutional treatment. A small but typical and very troublesome class educationally are those which, whilst not as a rule markedly defective mentally, yet are very dull, and often have exceedingly poor vision from interstitial keratitis or other ocular conditions, so that they are almost educationally blind; in addition, some of them, in the second half of school life, as a result of inherited constitutional taint, have some deafness, which, after persisting for a long time, suddenly progresses, and in a week or two, unless early and energetic treatment is followed, and in the majority whether or not, almost total deafness ensues. These cases we can do practically nothing with, and if over twelve, as most are, they are allowed to drift on till over school age. They generally end up quite deaf, seeing very badly, retaining speech, and being very stupid mentally, if not actually defective.

Many deaf cases are also mentally defective and incapable of benefiting by oral training; these are collected into a residential school, where all methods of communication—oral, aural, and manual, or signs—are used.

Some mentally-defective cases are blind, too, from optic atrophy, disseminated choroiditis, congenital cataract, or the results of ophthalmia neonatorum; these, in the case of boys, are sent to a special residential school, and in the case of girls to a branch of the residential home for elder blind girls.

The morally-defective girls are also in a separate residential home, but this is merely experimental at present.

In passing, it will be noticed that exact statements in figures have been everywhere avoided. Percentages are delusions where one deals with such various units as these individuals represent, and where the school population varies so much as it does in the different districts of the special schools. The publication of actual numbers, or, worse still, of percentages, is apt to be very misleading when all other circumstances are not taken into account. For instance, if we quoted numbers, it might be safe to say that there are

four times as many Mongols as cretins in London; probably the proportion might be reversed, however, in the West Riding of Yorkshire. Then, in regard to articulation, in 500 children recently noted by Mrs. Dickinson Berry, the boys under twelve years only present 21 per cent. bad, but over twelve there were 34 per cent. shown. Such defect does not mean that they got worse, but is quite accounted for by the fact that all the bad cases are retained till sixteen, whilst the more capable leave soon after fourteen. Again, these children had had special training in articulation, so that the 21 per cent. under twelve does not really show the number usually met with.

For these reasons, in estimating the future prospects of the mentally-defective classes, it is not safe to give a nearer estimate than that one-third are likely to be able to do well for themselves, and to call this an optimistic estimate.

The remaining two-thirds would probably be very much better in permanent custody, but certainly one-half of them are dangerous to themselves or others if not carefully guarded through life.

In passing from the subject of the future of these children, mention should be made of the very great difficulty which we know to exist at present in getting imbeciles who require custodial treatment into proper care. There is no authority charged with the care of non-pauper imbeciles, and poor people have to be pauperised even though they should pay all the cost for the care of their children in rate-supported institutions. But, in addition to this, many official obstructions are placed in the way of such children coming under the care of the Guardians.

What do we know of the origin of these individuals? An attempt has been made in the forms required by the Act to ascertain something of the history of these children, but, as the particulars are to be ascertained by teachers from parents, the information is of scanty value.

The most prominent fact elicited is the influence of family heredity—sisters and brothers and cousins are common in the special classes. A very common event is to get either all the

girls of a family affected and the boys escape, or *vice versa*. Most commonly it is the boys, but then, boys are the most numerous among mentally defective.

There is often very great difficulty in getting facts acknowledged or confessed. Relatives refuse to state feeble-mindedness, and even in relation to the children themselves they seem to have little difficulty in getting medical certificates to support their views in the clearest cases of mental defect; but one notes very frequently that the mother herself appears defective, or the father is peculiar. The mothers are oftener seen, but, apart from that, the defective woman, especially if good-looking, seems to have a better chance of matrimony than the man.

In the family histories insanity is most common, as well as epilepsy and history of mental defect—and it is insanity of early or middle life, not merely the mental senility, which is frequently also given. Forty per cent. of the congenitally weak-minded admitted to the London County Asylums have such neuropathic family histories, and those who have gone into the question of epilepsy find that at least half of the idiopathic cases give a family history of this, too.

This family history alone will account for all the other accompaniments. The neuropathic person is disposed to stimulants of some form. Alcohol is the commonest. Tea, coffee, morphia, cocaine, and all varieties of drugs are more elegant expressions of the same neurotic crave for stimulation. What is more is that alcohol in this kind of individual expends itself on the nervous system; "it flies to their heads" at once. So that alcoholism is exceedingly common in family histories of the feeble-minded, but alcohol is also a powerful protoplasmic poison, and probably the most powerful and widely-disseminated means of physical deterioration in this country: it lowers vitality, and it renders the nervous breakdown of the mentally defective certain; still, its undoubtedly considerable direct effect in actually causing congenital mental defect cannot be definitely assessed.

Syphilis, which yet is permitted to ravage the country unrestrained, is at first not a very obvious cause. It is only

extreme cases that present the typical physiognomy to be read at a glance; but on going into histories, we often get strong presumptive evidence unexpectedly, and the frequency of interstitial keratitis, disseminated choroiditis, or the typical deafness which has been alluded to in families where mental defects are also found make one suspicious that this plays a greater part than is first suspected in depressing vitality and leading to nervous imperfection.

Cases of mental failure in childhood, often in several members of a family, also occur probably due to this disease, and the disease known as Juvenile General Paralysis may be taken as practically always the result of inherited syphilis.

The frequency with which these depressing agents act, the fact that the generally inferior mental condition sends the family towards the submerged tenth, aided by the frequency of drink as a habit, means often irregular employment, a poor environment, bad food, miserable housing, discomfort, and want of rest, and the ever-haunting fear in the poorer classes of the possibilities of to-morrow, all tend to depressed vitality, and are also associated with the great frequency in family histories of the disease of bad environment and depressed vitality—phthisis. This disease is really the commonest actual cause of death of publicans and others whose work brings them daily into contact with alcohol, and who suffer its depressing effects on vitality. Phthisis is even more prominent in the family history of most of the defective children than alcoholism, and phthisis is also their commonest cause of death—nature's means for clearing off the idiot and the imbecile.

A great deal is heard about want of feeding of school children, and there are those who ascribe feeble-mindedness and general physical deterioration largely to this. We have not yet gone into the question as it should be done with measuring rod and weighing machine, but ill-nutrition, due to want of necessary food, cannot be connected with mental defect unless it be that ill-nourished mothers are prone to produce defective children, and even then one must remember that in this city of Birmingham alone it is computed

that over two millions a year are absolutely wasted on alcoholic drinks.

The offspring of this very class we have been considering degenerate, neuropathic, alcoholic, and phthisical, naturally often come under the Poor Law and are clothed, fed, and housed, growing into great fat sleek boys and girls, but remaining, in spite of regular food and careful attention, mentally so dull and defective that they go a long way to prove that ill-nutrition of the individual child may almost be neglected as a cause of mental defect.

Besides this class of degenerates who are selected by circumstances to people the slums, there is another selection going on in the country. There the intelligence of the people may be said to depend on the women, who keep the shops and do the work; the best of the men have passed to the towns; the dull and unenterprising remain to be the parents of the next generation. But for the women, who are the workers in the country districts, mental deterioration would soon be more marked; even now, however, it is said to be noticeable.

Whether in other ways we are tending to feeble-mindedness, it is hard to say; education *en masse* appears to have neglected the fourth R—reasoning. The lower brain centres may be polished to automatism in their action, and the higher centres be so neglected educationally, whilst the work of life has become so specialised that there is now, after a generation of Board schools, a physiological need, a want as it were, to occasionally flush neglected brain areas with blood and throw them into violent action, which shows itself in a craving for and is satisfied by excitement chiefly of the passive sensory sort.

The mentally defective nowadays are better protected; there is less room for them in the world, and they are better looked after, and their high death-rates are yearly lowered, so that they tend to increase in number. We have an increasing number of gamblers, criminals, public-house loafers, types of low-grade minds. The first necessity for the protection of society is that all these individuals should be known.

This is easy. The finger-print register, which Colonel Henry has introduced with such success at Scotland Yard, should be begun with the presentation of these children for the first medical inspection as candidates for special education. Such a finger-print register would be the first prophylactic against the numerous crimes in which this parasitic class indulge.

But prevention is better than cure. Dr. Langdon Downe nearly twenty years ago, in the Lettsomian Lectures noted that "Prolific child-bearing appears to be characteristic of people begetting feeble-minded children." Looking to the enormous part which heredity plays in mental defects and epilepsy, the best way is to prevent breeding from defective stock.

Here the difficulty is to say where the line is to be drawn, but the germ of that lies in the further development of the idea of the Children's Courts which have been established in this city. The Children's Court should be strengthened as an expert body. The appeal against any decision that a child is educationally mentally defective should be to this court. The question of custodial treatment (expensive, but sometimes necessary) should lie with the court, but permanent custody for such large numbers as would otherwise be required would not be necessary if there was legalised surgical sterilisation before the age of twelve years for every case under special education for over two years. Such treatment has but little immediate risk: it could do no harm to the individual, and would be of immense benefit to the race. Here again the final question in any case of appeal would be with the Children's Court.

Nature's method with the tubercle bacillus we have not attained the moral courage to consider. Old Assyrian doctrines, transmitted through several religious systems, perpetuate a system which holds human life as such to be so sacred that it must be maintained at all costs; otherwise, why should idiots be permitted to continue a useless existence?

In conclusion, the suggestions may not be practicable, but they are thinkable, that for all idiots and many imbeciles euthanasia is worth consideration. For all imbeciles and

most of the feeble-minded, sterilisation at an early age should be practised; and that every child whose case at any time has required investigation, registration by finger prints should be required; a continued fear of reference to such a register would do something through life to act much as conscience does in the normal individual.

There has been a strange apathy in England in regard to the hygiene and care of school children. Foreign countries have gone far ahead of us in many ways, but yet even for England the prospect is bright. At no time in the past dozen years has the health of the school child been of such general interest as at present, and this ought to be still further stimulated by the International Congress on School Hygiene which is to be held in this country in 1907. Meanwhile, you are to be congratulated in Birmingham for the leading part which your Educational Authorities have taken.

For your patient attention to this review of mentally-defective children as they appear to the school doctor, I have to thank you.

THE PROOF OF THE CURE OF GONORRHŒA: ITS BEARING ON MARRIAGE.

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ONE of the difficulties in the treatment of this disease arises from the fact that the patient is very apt to regard himself as restored, before a cure has been effected. As soon as the acute symptoms have subsided, and the pain and copious discharge have disappeared, he is likely to consider his complaint to have passed away, or at any rate to be no longer of importance; and therefore to withdraw himself from further treatment. Such a procedure is almost certain to be followed by a relapse, as the gonococci, not being entirely eliminated from the mucous membrane, are excited to greater activity by the patient's return to his former habits. It is necessary to emphasise the fact that the cessation of the discharge is no proof of the cure of the disease; and that the gonococci may remain in some portion of the urethra long after all apparent signs of the disorder have disappeared. It is therefore of much importance that we should carefully consider the means by which we may be able to decide definitely whether a cure has been effected or not.

Throughout the entire course of the disease the appearance and character of the urine form the simplest and best indication of the changes which are taking place in the urethral mucous membrane. So long as the urine is turbid with mucus, and, on standing, deposits a layer of pus, we know that the urethra is acutely inflamed. And this may be either the early stage of a recent infection, or an acute exacerbation of a chronic condition. If the urine is turbid, but instead of depositing pus, shows the presence of urethral threads, it is evident that the inflammation has passed into

the sub-acute, or catarrhal stage. And, lastly, the presence of threads floating in clear urine denotes the chronic, localised condition.

Whilst the disease is in the acute, or sub-acute stage, there is little likelihood of either doctor or patient regarding it as cured. It is in the terminal stage alone that the difficulty of deciding arises. And here the difficulty may be very great; and the decision arrived at may be of much moment to the patient. It may not merely involve the question as to whether it is necessary for him to continue the treatment, or not; but whether he is entirely free from the infection, and therefore in a fit state for marriage.

During the last few years the attention of the profession has been repeatedly drawn to the disastrous effects which gonorrhœa has upon the health of women. Previously it had been thought that, although the disease frequently gave rise to serious complications in the male, it was but a trivial, local malady in the female. We now know that this view was entirely wrong; and we have learnt to regard the disease to be not a whit less serious in women than in men. For, so far from the inflammation being localised to the vulva and urethra, it frequently spreads insidiously to the uterus, tubes, ovaries, and peritoneum, giving rise to grave trouble and danger in the form of endometritis, pyos-alpinx, perioophoritis, and pelvic peritonitis. It is also a common cause of abortion and sterility. There are few pictures sadder than that which, all too frequently, meets the surgeon's eye in the rapid transformation of a bright, healthy girl into a peevish, chronic invalid; the consequence of a gonorrhœal infection acquired early in married life.

It will at once be seen, therefore, to be of the utmost importance that we should be able to determine with certainty whether a supposed cure is actual or not; and so to be able to affirm with confidence that a patient who has suffered from this dire disease may marry without fear of infecting his wife. In order to do this effectually a most careful and systematic examination of the patient is necessary. No value whatever must be placed on his assertion, however confidently made, that all discharge has completely ceased, and

that there is nothing to be seen. Apart from the fact that he will naturally take the most favourable view of his own condition, the question cannot be determined by mere casual observation.

The first point to be decided is the presence or absence of the gonococcus in the urethral secretion, or in the mucous membrane. So long as the coccus is present, there can be no question as to the patient's infectious condition, and his requiring further treatment. At the same time it must be noted that the detection of the gonococcus in the later stages of urethritis is far from easy; and that it demands considerable experience and patience. For in this stage the micro-organism is present in very sparing numbers, and is no longer found in its characteristic situation, within the body of the leucocyte, as in the acute stage. Confusion as to the identity of the organism is under such circumstances much more likely to occur than in the earlier stages of the attack. All the resources of bacteriology may have to be invoked to establish the diagnosis. But, further, it frequently happens that the organism is absent from the secretion for days, and even weeks, together; and only reappears when the urethra is unusually stimulated from any cause, such as sexual excitement, or indulgence in alcohol.

In the intervals the micro-organisms may be lying *perdu* in some of the numerous crypts and follicles with which the urethra abounds. Hence, when attempting to decide whether the gonococcus is still present or not, it is necessary not only repeatedly to examine the secretion, at intervals, but also to take such steps as will induce a certain stimulation of the tract, and to pay special attention to the contents of the seminal vesicles, and of the prostatic and urethral glands.

It may be convenient here to discuss the details of such an investigation. The first step is to examine the urine (preferably that passed in the morning on rising) for any threads or deposit. If any be discovered they should be stained and microscopically examined. At this stage the threads will probably be found to consist of numerous epithelial cells and a few pus-cells held together by mucin.

Should the pus-cells largely predominate the probability that the disease is cured is distinctly small. If no gonococci are found, all treatment should be suspended; and, after an interval of a few days, the urine must be re-examined. If the disease is not cured the stopping of the treatment will probably lead to an increase in the number of the threads and, possibly, to the reappearance of the micro-organism. Should no gonococci be found, the contents of the seminal vesicles and prostatic glands should be expressed by massage per rectum, and their secretion examined. To obtain the contents of the urethral glands, the method of von Crippa is usually employed. A large acorn-headed bougie is swept up and down the anterior urethra, whilst the surgeon gently compresses the penis between the flat of his hand and the abdominal wall of the patient. By this manœuvre the contents of the crypts and follicles are expressed, and appear as a bead of secretion at the meatus, or clinging to the head of the bougie.

The next step in the examination is to ascertain if the gonococci reappear after stimulation of the urethral mucous membrane. To this end the restrictions which had been placed upon the patient's diet may be removed, more especially as regards the taking of alcohol; and he may be invited to drink somewhat freely of beer or wine on one day, and to submit himself to examination on the day following. Or the urethra may be irrigated with an irritating lotion, such as nitrate of silver (1 in 2,000), the day before the examination. Instead of, or in addition to, the irritating injection, the urethra may be dilated by the passage of a large bougie, or, better still, by means of a dilator. This last is the most powerful means we have of bringing any hidden focus of infection to the surface, for it not only irritates the urethra, but squeezes out the contents of the numerous mucous follicles, in the depth of which the gonococci are so apt to lurk.

A new method of bringing any hidden gonococci to the surface has recently been suggested by Alexander (Centralbl. f. die Krankheiten der Harn and Sexual-Organe Bd. 16.

Hft 4, 1905). It consists in the injection into the urethra of a dilute solution of peroxide of hydrogen. As soon as this fluid comes into contact with blood, pus or bacteria, it splits up into water and oxygen under strong effervescence. The gas so liberated mechanically detaches and carries away any broken down epithelial cells, leucocytes and bacteria which may be present. Alexander claims that by this means gonococci can be liberated and brought out of their hiding-place without injury or irritation to the mucous membrane, and that it avails in cases where all the usual methods have previously failed. For this purpose he uses Merk's preparation of H_2O_2, which contains 30 volumes by weight of peroxide of hydrogen, and dilutes it with 29 parts of water. The fluid is injected and allowed to remain for about a minute in the urethra. The foam which then exudes from the meatus is collected on a glass slide and, after being fixed and stained, examined microscopically. In my own, at present limited, experience of this method, I have found it simple and efficacious; but it is yet too soon for me to attempt to estimate its value in comparison with the other methods.

If, after a thorough and repeated examination, no gonococci can be discovered, are we justified, ipso facto, *in declaring the patient to be no longer infectious, and in giving our sanction to his marriage?*

On this point there is a difference of opinion amongst the various authorities. Some* would confidently answer the above question in the affirmative; on the ground that the only criterion of the infectiousness of a urethritis is the finding of the gonococcus. Other authorities,† however, are of opinion that it is not safe to rely solely on the negative evidence of the bacteriological examination, no matter how thoroughly soever it may have been made. They contend that due consideration must be given to other factors, such as the character of the urinary threads, and the appearance of the mucous membrane, as seen by the urethroscope. They hold, and my experience entirely confirms this view, that as

* Neisser, Jadassohn. Scholtz

† Oberlaender, Kollmann, Wossidlo, Levin

long as the threads are largely composed of pus-cells, one is justified in being suspicious that the gonococcus still lurks somewhere in the urethra. And they affirm that before the surgeon can confidently assert that the patient is no longer infectious, not only must the gonococcus be absent from the secretion, but also the mucous membrane must have regained its normal bright glistening appearance; its longitudinal folds must be clearly defined, and it must be free from all inflammatory areas.

Although the continued presence of threads containing pus-cells is rightly to be considered as a reason for regarding the patient with suspicion, yet we are far from being warranted in assuming, as Levin* does, that the gonococcus is therefore necessarily present. For such threads may be produced by other forms of urethritis than that arising from the gonococcus.

Should the microscopical examination show that the threads consist almost wholly of epithelial cells, the same importance must not be attached to their appearance in the urine. For it sometimes happens that, long after the gonorrhœal inflammation has subsided, such threads are passed, and are merely evidences of a desquamative catarrhal condition, kept up by the astringent injections.

If the persistence of threads formed of pus-cells is a sufficient reason to warrant the surgeon in hesitating to give his consent to tne patient's marriage, must it also be regarded as a condition demanding continuous treatment?

As long as such threads are passed, it is certain that some part of the urethra is still inflamed, and the patient cannot be regarded as in a satisfactory condition. A determined effort therefore should be made to ascertain the exact origin of the threads, and to cause their final disappearance. But in treating gonorrhœa, as. in fact, all diseases, the patient must be considered as well as the disorder. We must be careful lest in our anxiety to eradicate the last vestige of inflammation we unduly prolong the treatment, and, by centering the patient's thoughts too much upon his trouble, we induce serious neurasthenia and hypochondriasis.

* Levin, Wann können wir die Gonorrhœa als geheilt ansehen? "Arch. f. Derm. u. Spph.," Bd. 55, s. 32

Notwithstanding the very considerable advance which has been made in the treatment of gonorrhœa during recent years, an advance which enables us to cure an ever-increasing number of inveterate cases, it must, however, be frankly confessed that there are certain cases which it is not in our power thoroughly to cure, cases where the deeper structure of the urethra, and more especially the prostatic glands, are profoundly affected, and in spite of persistent and appropriate treatment some of the symptoms still persist. In such cases we shall only do harm by remorselessly continuing the treatment.

PRACTICAL TREATMENT.

THE TREATMENT OF ULCERATIVE COLITIS.

By WILLIAM MURRELL, M.D., F.R.C.P., *Physician to the Westminster Hospital; Lecturer on Clinical Medicine, Joint Lecturer on the Principles and Practice of Physic in the Westminster Hospital Medical School; and Examiner in the University of Aberdeen.*

THERE has been a notable increase in the number of cases of ulcerative colitis observed in London during the last three years. At one time it was a comparatively rare disease, and on consulting the records of the Westminster Hospital from 1884 to 1902 inclusive, I find there were only fifteen cases. To what the increase is due it is difficult to say : possibly it is associated in some way with the prevalence of appendicitis, or it may be connected with the convalescent dysenteric cases sent home from South Africa. In several of my cases there was a curious, although indefinite, history of contact with people who had suffered from intestinal disease during the war.

The term " ulcerative colitis " is admittedly a bad one, sanctioned only by long usage, for ulceration of the large intestine may be in origin dysenteric, malignant, tuberculous, or enteric. Much difficulty is experienced in distinguishing between the different forms of inflammation affecting the colon, and *post mortem* it is impossible from an examination of the large intestine alone to differentiate between ulcerative colitis and chronic dysentery.

Ulcerative colitis attacks both sexes, but is slightly more common in men than in women. The majority of cases occur between the ages of twenty and thirty years ; exceptionally it may occur in children. The clinical features of the disease are characteristic. The onset is insidious, there is no rigor, and nothing in the early stages to distinguish it

from an attack of common diarrhœa. Pain is not a prominent symptom, and tormina and tenesmus are absent. As a rule, no cause is assigned by the patient. The temperature is persistently high, varying for many months from 100° to 103° F.; sometimes it is but little elevated, and it is usually subnormal during the last forty-eight hours of life. Diarrhœa is always a prominent symptom, and is practically unceasing, there being often from 60 to 100 motions in the twenty-four hours. The motions are liquid and offensive, rarely formed, consisting of mucus with or without blood. Microscopically they show torulæ, streptococci of various kinds, bacilli (the *B. Coli communis* and others), with pus, epithelial cells, and the *débris* of food. Vomiting may be persistent, but is sometimes absent, or occurs intermittently. The tongue is clean, red, and irritable, or covered with dirty brown fur. There is no loss of appetite, and the patient urgently demands more food, in spite of the fact that it increases the diarrhœa. Loss of weight is always noted, and is usually at the rate of 3lbs. or 4lbs. a week. There is loss of energy, and the patient is usually anæmic. The anæmia, however, is never intense, and even after many weeks of illness the erythrocytes may number over 4,000,000 per c.mm., with hæmoglobin 60 per cent. or more. There is no mental depression, and the patient remains bright and cheerful to the end. Bed sores and ischio-rectal abscesses are common, but nothing is found in the liver. The duration of the disease is variable, and may extend over a period of three or four years.

The *post mortem* appearances present considerable uniformity, and there is always a condition of ulcerative colitis throughout. In the ascending and transverse colons, numerous circular punched-out ulcers, varying in size from a threepenny piece to a florin, are seen. The mucosa of the colon from the splenic flexure to the anus is extensively ulcerated, the remaining mucosa being much thickened and standing well up above the ulcerated surface.

Not infrequently the appendix is involved, and it may be glued to the pelvic brim by adhesions or may contain fæcal calculi.

Medical treatment commonly fails to do any good, not even ameliorating the symptoms. In a series of cases under my care, the following modes of treatment proved inefficacious :—(1) Opium and morphine in all forms given by the mouth, hypodermically, or in enemata; (2) carbonate of bismuth in large doses up to half an ounce every four hours; (3) salicylate of bismuth; (4) astringents, including perchloride of iron, sulphate of copper, and acetate of lead; (5) intestinal antiseptics, including *B.* naphthol, salol, and various preparations of formic aldehyde; (6) ipecacuanha given dry and with the usual precautions; (7) sulphate of magnesium and sulphate of quinine given alternately.

Surgical treatment has been attempted, but the results are not satisfactory. The operation commonly performed is that of establishing an anastomosis between the ileum and the lower end of the colon, or, failing this, a right-sided colotomy. In one of my cases Mr. Walter Spencer attempted catheterisation of the appendix, washing out the bowel freely from above with douches of normal saline. The result was unsatisfactory, but it is possible that if it had been performed earlier it might have been successful. The only method of treatment I have found efficacious is the injection by the rectum of argyrol— a chemical combination of silver with synthetic vitellin containing 30 per cent. of silver. The following cases are illustrative :—

Case I.—A man, aged sixty-four years, was admitted into Westminster Hospital on May 28th, suffering from ulcerative colitis. He was born in England; his father was an Englishman, and his mother a native of Calcutta. When a few months old, he was taken to India, and remained there until the age of thirty-six years, when he returned home. Whilst in India his health was perfect, and he had neither diarrhœa nor dysentery. About ten years ago he developed a chronic and intermittent diarrhœa, which during the past twelve months had been accentuated, the bowels as a rule acting four times in the day and five times at night. He had attended as an out-patient for nearly a year, but the diarrhœa continued with unabated severity in spite of much

treatment. He had been steadily losing flesh and strength for some months. There was no cough, and no night-sweating.

On admission, and for some days subsequently, the temperature was elevated, varying from 99.4° to 101.8° F. There were usually from five to seven motions in the twenty-four hours, the stools being fluid, fairly copious, slimy, free from blood, and not offensive. There was no vomiting. There was hyperæsthesia on deep palpation all over the abdomen. The tongue was clean and moist.

The patient was dieted and given acetate of lead and other astringents, but without benefit, and his general condition was unsatisfactory. From June 5th to 9th inclusive he had twenty-three motions. On the 10th, after a preliminary enema of boric acid, eight grains to the pint, he was given, by means of an irrigation tube of small diameter, a rectal injection of a 1 per cent. aqueous solution of argyrol at a temperature of 80°. When about five pints had been introduced, the patient being in the knee-and-elbow position, attention was called to the fact that a claret-coloured, odourless fluid was pouring out of his mouth, a fluid identical in colour and appearance with that in process of injection into the rectum. The time from the commencement of the injection was four minutes. There was some nausea, but no retching or vomiting, and the fluid as it flowed from the mouth was received into a clean white porringer. A suggestion being made that it was altered blood, it was examined both microscopically and by the usual tests, but no blood was present. It was examined for bile, and again with a negative result. The patient had taken nothing in the way of food but some tea early in the morning, and subsequently a little milk and bread and butter. The specimen was sent to Dr. Wilson-Hake at the Westminster Hospital Medical School, who reported that it was a solution of silver not differing apparently from a 1 per cent. argyrol solution with which it was compared.

The patient seemed none the worse for the injection, and had a fairly good dinner. On the following day he had only

three motions, and on June 12th the same number. The temperature was normal on the 11th, but on the 12th it rose to 102.4°, falling again in a few hours to normal. From this time there was no return of the diarrhœa, the bowels never being opened more than once a day. As a matter of precaution, the injection was repeated on the 14th and 16th, but there was no repetition of the regurgitation of fluid from the mouth. In a few days the patient was able to take meat and potatoes and green vegetables. He rapidly regained weight, and on July 6th was discharged. He was seen again two months later, and was then perfectly well.

The foregoing case illustrates not only the curative effect of an injection of argyrol into the bowel in ulcerative colitis, but the fact that a fluid introduced into the rectum may be discharged unaltered by the mouth. The evacuation of a substance injected into the rectum in so short a period as four minutes is noteworthy. It may be suggested that there was a short circuit between the rectum and the stomach, but there was nothing pointing to the existence of so abnormal a condition. The occasional vomiting of enemata by hysterical and other patients is not unknown, and many cases are recorded. Many years ago Nothnagel reported, as the result of a series of experiments, that anti-peristalsis never occurred in the normal uninjured intestine if no pathological influences were brought to bear on it. The effect was investigated of the injection into the rectum of various fluids coloured with carmine, *post mortem* examination showing whether they had been carried higher by any movement of the intestine itself. The best results were obtained with from three to five cubic centimetres of a strong solution of chloride of sodium, but the staining never reached farther than the cæcum. Angeraut, in a thesis published in Paris in 1894, affirmed as the result of experimental investigations that the ileo-cæcal valve did not always present the adequacy attributed to it by anatomists, and that it might be permeated by fluids introduced into the rectum. Coutani has recorded two cases in which, after injections of large quantities of olive oil into the rectum for the relief of constipation, the

patients were seized with eructations and vomiting, the vomited matter containing oil. Jaccoud mentions the case of a hysterical young woman who from time to time vomited motions which were formed, cylindrical, brown in colour, and of characteristic odour. Fully realising the deception often practised by such patients, every possible precaution was taken, but the phenomenon continued. Ten days later the patient contracted enteric fever, dying in the third week, but at the necropsy no anatomical peculiarity was detected, there being nothing observable but the characteristic lesions of the disease. Briguet reports a case in which an enema of coffee was vomited a quarter of an hour after its administration. Experimentally, an injection was given of a fluid, coloured blue with tincture of litmus, and in twelve minutes it was rejected by the mouth, having been turned red by the acid of the gastric juice. In a similar manner a saline injection was evacuated by the mouth, and gave the usual reaction with nitrate of silver. Pie mentions a case in which an injection of 150 grammes of almond emulsion, containing ten minims of tincture of opium, was vomited in half an hour, the patient distinctly recognising the taste of the laudanum. Suppositories even are sometimes rejected by the mouth. Sennest records the case of a girl, aged twelve years, who vomited a large suppository introduced into the rectum, "dans le temps de réciter un *Pater noster* et un *Ave Maria*." A second suppository secured by a thread was then introduced, but the reverse peristalsis was sufficiently strong to break the cord, and the suppository was vomited with the fragments of thread attached. A third suppository was tried, secured by four strong ligatures, but the result was the same.

Case II.—A postman, aged twenty-four years, suffering from ulcerative colitis, was sent to the hospital for treatment on November 16th, 1904, by Dr. H. E. Hewett, of the Medical Department of the General Post Office. The patient stated that eight months previously he had been in hospital at Lewisham for what was supposed to be enteric fever. Prior to that and for a year or more he had suffered much from constipation. After his acute attack, he remained in

good health until four weeks before admission, when he noticed that his motions, which were passed frequently, were fluid and blood-stained. The evacuations soon became more frequent, more slimy, and contained more blood. There was pain in the abdomen, especially after defæcation. The appetite remained good, but there was considerable loss of weight, and he was unable to follow his occupation. Patient's brother, who had had recurrent attacks of dysentery in South Africa, had returned home eighteen months previously, and they had occupied the same bed.

On admission, the patient was thin, but fairly well nourished, and of good colour. His weight was 8 stone 13lbs. His daily temperature ranged from 99° to 102°. There were on an average five motions in the twenty-four hours—fluid, and containing much mucus, with some blood, but not offensive. Vomiting was frequent, and there were thirty attacks in nine days. A uniform tympanitic note was detected over the abdomen, reaching on the right side three inches above the costal margin. The urine had a sp. gr. 1030, was acid, and contained no blood and no albumin. An examination of the blood showed red cells 5,420,000, and white 23,600 per c.mm., with hæmoglobin 90 per cent.

The patient was at first placed on fish diet, but as this increased the diarrhœa, he was restricted to liquid nourishment. A mixture of bismuth and hydrocyanic acid with capsules of creosote and carbolic acid failed to effect any improvement. His weight fell rapidly to 7 stone 10lbs., and his general condition was unsatisfactory.

On November 29th, after two preliminary enemata of boracic acid solution, eight grains to the ounce, he was given a high rectal injection of a 2 per cent. solution of argyrol, diluted with an equal quantity of boiling water. Five pints were introduced by syphonage, the operation lasting nine minutes. Some of the fluid returned, but most of it was retained. The patient vomited after the injection, but there was no argyrol in the vomit. On the 30th there were four motions and the patient was sick once. On December 2nd the highest temperature was 100°, and there were eight

motions, with one attack of vomiting. On the 3rd the highest temperature was 99°, and there were eight motions. After this the patient rapidly improved; there was no more vomiting, and the bowels were relieved only once or twice a day, the motions being formed and free from blood and mucus.

The first chart shows the temperature and general condition of the patient a few days before the injection.

The next chart illustrates the condition a few days after the injection.

The patient made an uninterrupted recovery. From the 8th to the 17th there were no motions and there was no vomiting. The temperature was normal, and he gained weight at the rate of about 8lbs. a week. He was placed on solid food, with vegetables, and on Christmas Day had for dinner a plentiful helping of turkey and pudding. On December 26th he was able to get up, and left the hospital on January 4th, 1905, apparently in perfect health.

I have had four similar cases in private practice, but of these I have no notes. For the preliminary injection, a solution of borax will be found better than boracic acid, as it is less irritating, and more speedily clears away the mucus.

REVIEWS.

Diseases of the Heart. By EDMUND HENRY COLBECK, M.D., F.R.C.P. Second edition. (London: Henry Kimpton.)

So practical and sound a book as Dr. Colbeck's "Diseases of the Heart" was certain to appear in a second edition. We may remind our readers that the object of the book was in the first instance to supply the senior student and practitioner with a bedside work on the cardio-vascular system. The author therefore keeps in the foreground the clinical examination of the circulatory system and the method of estimating the value of the heart and vessels in the varying phases of heart disease. In the second edition some new matter has been introduced—some alterations and corrections also appear. The chapter on Functional Disorders of the Heart is amplified, and includes a section on Cardiac Asthenia and Stokes Adams' Disease, and several sections have undergone modification. The chapter on "The Pulse" is, in our opinion, one of the best in the book, and is one that the student will benefit by reading with care. We have no hesitation in saying that Dr. Colbeck's book gives a lucid and practical account of the subject of heart disease.

Diseases of the Liver, Gall Bladder, and Bile Ducts. By H. D. Rolleston, M.A., M.D., F.R.C.P. (London: W. B. Saunders and Co. 1905.)

THIS work is the result of twelve years' unremitting study of the diseases of the liver, and with this subject the author's name has long been intimately associated, and his views therefore are certain to carry weight.

The book is divided into three parts, of which the first deals with the diseases of the liver proper. We are glad to note that the author omits all description of the anatomy, naked eye and microscopic, of the liver, remarking with great

reason that the reader will be well advised to consult the various text-books of anatomy and histology. The writer has therefore more space to devote to diseased conditions of the liver, and of these there is a long series. Beginning with displacements and hepatoptosis, lesions of the vessels, systemic and portal, and the lymph channels are next described. In fact the ground covered is so wide that it is impossible to even mention the various sections.

As may be expected, the ever interesting subject of cirrhosis occupies a large portion of Part I. (pp. 174-355). The classification adopted by the author is founded on the basis of morbid anatomy, viz. :—Multilobular, which includes all portal toxic forms; Monolobular, essentially relative to biliary inflammation; Pericellular, as in congenital syphilis, Mixed, in which the previous groups occur together; Sporadic, *i.e.*, cases showing isolated fibrotic patches. This is a simple method of dividing the cirrhoses of the liver, but in some respects it is not satisfactory; thus we do not understand the last group—sporadic—for we are not prepared to include in cirrhosis the fibrotic changes occurring round a gumma, a cyst, or a healed abscess, preferring to reserve the term cirrhosis for general chronic interstitial hepatitis. Opinions are, however, bound to differ on this abstruse subject, and we do not think any classification yet suggested will meet with unreserved acceptance. For our own part we think that of Chauffard (referred to by the author on p. 174) is one of the best, and although the objection of its being "too elaborate and overlapping" may to some extent be true, the same may be said of many others; it has in our opinion the advantage of showing the differences between the various forms of cirrhosis, but at the same time their relations to each other, and even admitting the accusation of tending to overlap as just, we prefer it to his own. On the questions of classification and morbid anatomy, however, opinions are bound to differ, and although we cannot agree with the author's method of dividing cirrhoses of the liver, we can say truly that his long, scholarly chapter is highly instructive, and shows evidence of years of research.

The chapter on Cystic Diseases of the Liver is interesting. Here also the author's own researches give a practical turn to his writing. Unfortunately he does not make any definite statement of his own views on congenital cystic diseases, although he carefully expounds those of others, viz., the inflammatory (Babinsky, Michaloviez), the neoplastic (Rindfleisch), the degenerative (Pye-Smith, Pillet), and developmental (Still. Shattock).

Part II., Diseases of the Gall-bladder. In this part are included the inflammatory diseases, acute and chronic, parasites and neoplasms.

In Part III. are described the diseases of the bile ducts, including cholelithiasis. Here we are conscious of overlapping, for the relations between the gall-bladder and the biliary passages are so intimate that to divide them is to introduce an artificial element.

Dr. Rolleston's book is certainly a monograph, and in its thoroughness is, in our opinion unique. It is certainly the work that will take the leading place in English medical literature in its own department. We must not omit to say in conclusion that the references to records of cases, special articles and foreign works are very numerous, and must have cost the author great labour.

The Nervous Affections of the Heart. By GEORGE ALEXANDER GIBSON, M.D. (Young J. Pentland, Edinburgh and London.)

THIS book is a reprint of the Morison Lectures, delivered by the author before the Royal College of Physicians of Edinburgh in 1902-3, and which, as many will remember, appeared in the *Edinburgh Medical Journal*. Dr. Gibson has broken new ground in his Morison lectures, for although much of what he says has been common knowledge, the value of his investigations in showing the relationships of certain symptoms is great.

In the first section the sensory disturbances of the heart are described. Thus by the aid of some very carefully executed diagrams the author shows the distribution of

cardiac pain under a variety of circumstances, and by schemas of the cardiac nerves and their connections he explains the, at times, rather anomalous location of pain. Speaking of angina pectoris, Dr. Gibson is very emphatic in stating that angina is not a definite disease, and therefore its division into "true" and "false" is "an entire anachronism in the twentieth century." Cardiac pain as a whole is more satisfactorily divided into organic and inorganic. In the former are included pain due to alterations about the origin of the aorta, that caused by changes in the walls and lumen of the coronary arteries, or by modifications in the structure of the myocardium as fibrous, fatty, pigmentary, and gummatous, also pain due to aneurysm and tumour. The inorganic group includes the toxic and neurotic forms of cardiac pain; alcohol, tobacco and tea are instances of chemical toxines; influenza, malaria, diphtheria, and typhoid represent the microbic. The neurotic group is, in the author's opinion, extremely important, and one which is insufficiently recognised. The importance of neurasthenia and hysteria in causing cardiac pain is real. We can only refer the reader to the book itself for an adequate exposition of the subject. One of the chief chapters in the book is that on therapeutics, but so full is it of practical suggestions that we must again refer those who are interested to the original.

In the second section are three lectures on Rate, Rhythm and Force—that is, disturbance of motion. An interesting explanation of the Stokes-Adams syndrom is given (p. 65). In sclerosis of the cerebral vessels, whenever there is any stress put upon the circulation the blood supply to the brain is inadequate and ineffective. There is, as a result of that deficient supply, a condition of irritable weakness of the inhibitory mechanism; impulses are sent down to the heart; it is inhibited and the features of the attack—paroxysmal bradycardia—are found. The chapters on alterations of the rate, the rhythm and the force of the heart bear evidence of much thoughtful work, and are highly instructive. Dr. Gibson has made a valuable contribution to one of the most interesting subjects of modern medicine—diseases, other than

valvular, of the heart, and his work reflects the best traditions of Edinburgh.

The Medical Annual, 1905. (John Wright and Co., Bristol.) THE *Medical Annual* appears this year in an enlarged form, and commences a new series. In the words of the editor, "we have found it necessary to bow to the inevitable and adopt a larger page. It has become impossible to any longer keep down the size of the volume without impairing its value." Otherwise the *Annual* in no way departs from its high standard of practical utility. The year's work is presented to the reader after careful revision in order that he may obtain an intimate acquaintance with the present position of medical knowledge.

As stated in the preface, the subject of Tropical Diseases has advanced to such an important position that it has been given a leading place in this year's *Annual*, several diseases being described which do not appear in the ordinary text-books.

Dr. William Murrell contributes an excellent article on Colitis, in which he tersely reviews the subject and gives practical suggestions for treatment. An interesting article on Pneumonia is written by Dr. De Lancey Rochester, of Buffalo, in which he gives a good review of the treatment, adding several suggestions which are not as a rule mentioned in the text-books.

One of the most suggestive articles in this year's *Annual* is "Dyspepsia," hyperchlorhydria being the dominant note. Among surgical articles we notice that on Tendon Transplantation. There are numerous contributions to the literature of special departments, all being of great value. We have been in the habit of referring to a few only of the many articles in the *Medical Annual*, not that those unnoticed are not deserving of mention, but, such is the wealth of material, it is impossible to do otherwise. We cordially congratulate the editor and publishers on the excellence of the *Medical Annual* for 1905, and on the enterprise shown in introducing important changes.

Meals Medicinal. By W. T. FERNIE, M.D. (John Wright and Co., Bristol.)

IT is difficult to say exactly what is meant by "Meals Medicinal." It is not exactly medical, nor is it a treatise on Cookery; it is, however, very interesting reading. There is given an amusing semi-historical account of most of the every-day articles of diet, with methods of preparation long since forgotten in many cases. There are apt quotations from the literature of England, France, and Ancient Rome, many of which are "pauky," to use an expressive Scotch word. Concerning fish we are told—

"The Christians are ninnies, they can't fry Dutch plaice,
Believe me, they can't tell a carp from a dace."

Rabbit flesh, though physiological, does not seem to have "gone down" with everyone, for—

"There was an old person whose habits
Induced him to feed upon rabbits;
When he'd eaten eighteen he turned perfectly green,
Upon which he relinquished these habits."

Eggs seem at all times to have been a popular article of diet. Any way, we believe we have met the following somewhere, though otherwise served up—

Dumptius in muro sedet teres atque rotundus,
Humptius heu! cecidit magna ruina fuit
Non homines non regis equi miserabile dictu
Te possunt sociis reddere Dumpti tuis.

We do not wish it to be thought that the whole book is a "skit" and not to be taken seriously. Quite the contrary; there is much that is as instrucive as entertaining, and, as already stated, it is very interesting. Those who are concerned with dietetics and cookery should certainly read it.

Précis de Chemie Physiologique. By ALLEGRE CHASSEVANT. (Félix Alcan, Paris.)

PHYSIOLOGICAL Chemistry is a subject which is not sufficiently known to the average medical man. That it is difficult there can be no doubt, but that it is important is quite as

true. The object of Prof. Chassevant's book is to present the subject in as clear and practical a method as possible. As is usual with writers of the author's nationality, the dominant character is lucidity, and we certainly wish we knew of such a work in English, one that is as full without being ponderous, or as concise without being a "cram." The work is divided into three parts. In the first are described the constituents of the body and their varieties and derivations, *e.g.*, Lecithins, urea, purin bodies, cystine, &c. The second part treats of the fluids, blood, chyle, serum, and pus, muscular and other tissues. The last and chief part is concerned with the chemical processes of the body, such as respiration, digestion, the ductless glands, and urine. The last chapter of Part III. is devoted to the subject of Diet, and here are described foodstuffs, and diets suitable under different circumstances of health and disease.

The author appears to have kept in view the requirements of the clinician and therapeutist in his arrangement of his material, for relatively more space is allotted to the urine, gastric juice and bloods. The chapter on the urine is one of the most comprehensive we have seen, and is an excellent instance of how difficult chemical analyses may be satisfactorily made even by those who are not expert chemists, and no difficulty will be found by the ordinary clinician in estimating sulphates, and conjugated sulphur compounds, or in separating different forms of albumin provided he follows the writer's directions. In fact Prof. Chassevant's Manual of Physiological Chemistry ought to be translated for the benefit of English readers who desire a thoroughly practical work on this subject.

Nothnagel's Practice. Diseases of the Intestines and Peritoneum. By PROF. HERMANN NOTHNAGEL. Edited by H. D. ROLLESTON, M.D. (London : Saunders and Co.)

WE are tempted to say that of those volumes of Nothnagel's Practice already published this is the best, though to do so would seem invidious. Certainly the volume on Diseases of the Intestines and Peritoneum is one of the most interesting

and instructive books we have seen for some time. This may be due to the fact that the personality of the writer, Prof. Nothnagel himself, pervades its pages; further, the subject matter is peculiar in being indefinite in many respects, and it therefore greatly depends on the writer to make it interesting or the reverse. Lastly, we feel we give expression to what must be the general opinion of our readers in saying that the valuable additions made by the editor considerably enhance the value of the book. Among many chapters which we should like to review, we particularly notice that on "Mucous Colic and Membranous Catarrh of the Intestine," which, though short, very adequately presents the subject to the reader; though we are not prepared for the author's statement that " the necropsies at present available are very few." Ulcerative Colitis is not included, being incorporated in the chapter on " Ulceration of the Intestine " (pp. 238-276)—one worth careful study—as the varieties of ulcers occurring in the intestines are grouped in a practical manner.

In describing " Intestinal Occlusion," we think that treatment is somewhat traditional, as many methods are described which modern surgical procedures have relegated to the lumber room. At the same time a carefully written section on the operative treatment of Occlusion is added. There are several beautifully executed plates illustrating the appearance of the abdomen in intestinal occlusion.

The second portion of the book deals with Diseases of the Peritoneum, opening with a description of ascites. The pathology of ascites is by no means clear, and we regret that the author does not give us his veiws on some of its moot points; he takes refuge in generalities just when something definite would have been acceptable. Thus in speaking of the pathogenesis of ascites in renal diseases and cachexia, he says : " We are forced to the conclusion that the absorptive powers of the peritoneum become insufficient." Again, in a paragraph on Ascites occurring in Chronic Peritonitis, very brief mention is made of the difficulties in explaining the causation of the fluid. Even in the chapter on Chronic Indurative Peritonitis, no attempt is made to

assist us in understanding this difficult pathological problem. The treatment of many peritoneal conditions is confessedly difficult and unsatisfactory; therefore too much must not be expected, but on the whole we should have liked more on this subject. For instance, the account of treatment of Tuberculous Peritonitis is certainly too brief.

In conclusion, we can repeat that Nothnagel's "Diseases of the Intestines and Peritoneum" is a book that will instruct all who read it, and we sincerely congratulate the publishers on its appearance in this country.

Obesity: The Indications for Reduction Cures. By CARL VON NOORDEN, M.D. (Bristol: John Wright and Co.).

THIS is one of a series of Monographs on Diseases of Metabolism, written by Prof. von Noorden, and for the translation we are indebted to Dr. Boardman Reed, of Philadelphia. The scope of the essay is the treatment of obesity. In an introductory chapter the author points out the importance of forming a clear idea of the cases which should undergo treatment. He says the question is too frequently settled by the patient, for at different stages and under different conditions the necessity for undergoing a reduction method of treatment varies. "We possess so many physical means of treatment and such a large variety of dietetic schemes that in deciding on a method of reducing fat, the peculiarities of each individual patient can without difficulty be considered and included in the calculation." This sentence shows the author's attitude towards the subject, and his wish to place the treatment of obesity on a sound scientific basis. He next proceeds to discuss the relationship of pulmonary, cardiac and other diseases, especially the arthritic, to obesity, and he demonstrates the importance of treating the latter. In fact, the main purpose of the essay is to give the indications for reduction cures rather than the details of the methods themselves. We believe Prof. von Noorden's treatise on Obesity will bring home to many that this is a condition as worthy of clinical study as any disease of lungs or heart.

ABSTRACTS.

SOME RECENT WORK UPON DISEASES OF THE BLOOD.

Morphology of the Leucocytes.—The study of the white corpuscles dates from Virchow's investigations upon leukæmia and Cohnheim's discovery of the emigration of the white cells of the blood in inflammation, but their work remained clinically fruitless until Ehrlich introduced the investigation of stained dry specimens, and so gave the impulse to the modern histology of the blood. Ehrlich's classification of leucocytes and views as to their origin ever since have dominated the situation, and have been of incalculable value in the differentiation of blood diseases. There are signs that we are now entering upon a third stage of progress; the views of Ehrlich are being subjected to much criticism and modification; the origin of the leucocytes is being pushed farther back, and much light is being thrown upon the relations of such diseases as chloroma, myelomatosis, lymphadenoma, and leukæmia which apparently present widely different characters.

Ehrlich divided leucocytes into two great classes—granular and non-granular. The granular are derived from the bone-marrow, the non-granular from adenoid tissue. The former are capable of spontaneous movement, and their emigration under the influence of chemiotactic stimuli gives rise to active leucocytosis; the latter have no independent mobility, and are only passively washed into the blood stream by mechanical forces (passive leucocytosis). An anomalous position was held under this theory by the large hyaline mononuclear cells, for, although non-granular, Ehrlich sharply distinguished them from lymphocytes, especially by the fact that they might pass *via* transitional cells into neutrophile polymorphonuclear cells, and that their place of origin was thought to be the marrow. The position of

these cells has been the subject of much investigation, and most authorities now seem to class them with the lymphocytes. Gulland,* for instance, believes that the lymphocytes, hyaline and transitional cells, are merely stages in the development of one cell, and that no relation exists between transitional and polymorphonuclear cells. The reasons assigned by Ehrlich for the distinction between lymphocytes and mononuclears were, briefly, the cystoplasm of the latter is not so basophile, the nucleus is relatively smaller, granules occur in the transitional cells, and they are of larger size. Gulland shows that the cytoplasm is not so basophile because there is more of it, and the basophile parts are less crowded together. The shape of the nucleus is of little importance; neutrophile myelocytes and polymorphonuclears belong to the same series, but have very different nuclei; and, as Ehrlich has shown, pus cells often have oval nuclei, although derived from polymorphonuclear cells. Granules are really nodal points in the reticulum of the cytoplasm, and these nodes are less conspicuous in small lymphocytes, being hidden by the thicker strands. In large mononuclear cells the nodes are larger. The granules differ from those of the polymorphonuclear cells in being not neutrophile, but basophile, and Wolff† regards them as specific for the lymphocytic series. The size of the cell is also of little importance, and depends upon the taking up of fluid, as is shown by the separation of the strands of the cytoplasm, and by the cells being soft and easily indented by red corpuscles. A further proof of identity is the fact that both mononuclears and transitionals are found in lymph glands, and also in the lymph from the thoracic duct and large lymph vessels. The attempt to distinguish between their powers of movement must also be abandoned, as small lymphocytes have amœboid power although it is restricted in range by the small amount of cytoplasm (Hirschfield,‡ Ewing§). It would be well, then, if we simplified matters by disusing the terms hyaline,

* *Brit. Med. Jour.*, p 582, Sep. 1904
† "Zeits. f. klin. Med.," 1902. Vol. XLV., p. 385
‡ "Berl. klin. Woch., 1901
§ "Clinical Pathology of the Blood," 1904

transitional, or large mononuclears, unless it be clearly understood that these terms apply solely to varieties of lymphocytes.

We can now, therefore, classify leucocytes into four series—lymphocyte, neutrophile, eosinophile, and basophile (mast) cells.

Much important knowledge has been obtained from the study of embryonic bone-marrow, which has shown that the sharp division into two classes made by Ehrlich can no longer be maintained. Hirschfield,* Dominici,† Pappenheim,§ Browning,¶ and Gulland¶ agree in regarding a non-granular wandering cell with rounded or oval nucleus as the primitive type, which appears first both in phylogenetic and ontogenetic development. This cell, called by Wolff a "lymphoid" cell and by others a "leucoblast," is almost identical with a large lymphocyte, and is the first to appear in the fœtal blood. The eosinophile is the next cell to be developed, being found in the marrow before the end of the fourth month of fœtal life. Neutrophile granules identical with those found in the adult do not appear till later, probably between the fourth and sixth months. The marrow is, however, not the only seat of the formation of leucoblasts; the process is carried on widely throughout the perivascular connective tissue of various organs, especially of the liver and thymus. They can, indeed, be found in these situations in the ten weeks' embryo, when the marrow can scarcely be differentiated. By many observers (Pappenheim, Wolff, Grawitz, and Rubenstein), it is held that the "lymphoid" cells not only give rise to all the forms of leucocytes, but also to erthrocytes; but Gulland takes exception to this as the result of his observations on a rabbit embryo. In later fœtal life, blood formation becomes specialised, and at birth is confined to the marrow and adenoid tissue, the marrow cells confining themselves to the production of granular cells, the adenoid tissue non-granular cells (lymphocytes). But this differentiation is never so complete but that when

* Virchow's "Archiv.," 1898. Band CLIII., p. 335
† Cornil and Ranvier "Manuel d'Histologie Pathol.," 1902, II., p. 581
§ "Zeit. f. klin. Med.," 1902, XLVII., p. 216
¶ *Brit. Med. Jour.* Sep. 10, 1904

a demand for a greater number of cells of one type occurs the lymphoid cells in any blood-forming organ are able to produce that type, and, as Hutchison states, "the nearer the organism stands to the fœtus, the more easily can a return to fœtal conditions take place, and the lymphoid cells of the marrow assume vicariously the function of producing lymphocytes, and those of the adenoid tissue that of producing granular cells."

Muir* points out that the distribution of the different cells is related to the time of their development. The oldest cells—lymphocytes and hyaline cells (*i.e.*, swollen lymphocytes)—have the widest distribution, being found in the blood and all the tissues of the body; the eosinophiles are more restricted, but still occur considerably in the tissues, especially in lower mammals. The finely-granular cells are normally restricted to the blood and marrow. These facts have interesting bearings on those of pathology. The non-granular cells have a very wide range of activity, but especially in subacute and chronic conditions—exceptions being typhoid fever, anthrax in man, and smallpox. Gulland suggests, from their collection around the hollow tubes of the body, the alimentary and respiratory tracts, that they are adapted to keep in check saprophytic, non-virulent, and attenuated organisms, but are not sufficient to resist virulent infections. The eosinophiles are attracted by special chemiotactic substances in relatively non-acute conditions. The finely-granular cells are *par excellence* those which re-act in acute bacterial infections, and are especially adapted to the conditions obtaining in warm-blooded animals.

These modern views are represented in the following scheme of Wolff, which is used in Hutchison's lectures :—†

LYMPHOID CELL

Large lymphocyte
Small do.

Erthrocytes

Myelocytes
(*a*) Basophile
(*b*) Neutrophile
|
Polynuclear leucocytes
(*a*) With basophile granulation
(*b*) neutrophile

* *Brit. Med. Jour.* Sep. 10, 1904

† *Lancet.* May 7, 1904., p. 1255

Leukæmia.—These new ideas are profoundly modifying our knowledge of leukæmia. The old clinical classification into splenic and lymphatic forms gave way to the pathological classification of myelogenous and lymphatic leukæmia based on the predominant cell found in the blood. But now we are faced with the facts that in many typical cases of lymphatic leukæmia the bone-marrow alone has shown pathological changes, and in cases clinically of pure myelogenous leukæmia, myelogenous changes have been found in the adenoid tissue. A myelogenous leukæmia may become lymphatic in type, mixed forms occur, and finally lymphadenoma may terminate in leukæmia. Such cases are difficult to explain if Ehrlich's rigid classification be accepted, but the newer view is that both red and white blood cells may be considered capable of arising from the same type of cell, and so, according to the nature of the irritant, we may get increased development of leucocytes or erythrocytes, the former producing leukæmia, the latter pernicious anæmia; a combination of the two is probably possible, and is known as leucanæmia. We may omit the question of erythroblastic proliferation, and consider only the leucocytes. Leucoblasts, according to our theory, may be developed in the marrow or adenoid tissue. The marrow has been found affected in all cases of leukæmia; the spleen and lymphatic tissues may or may not be affected. If the formative cells of the marrow produce chiefly lymphocytes, there is lymphatic leukæmia. In myelogenous leukæmia the marrow cells produce chiefly myelocytes. Lymphocytic and myelocytic leukæmia are the new terms for these conditions. It is possible to find all degrees of preponderance of one or other cell, and these may vary so that the leukæmia changes in type with a change in the nature of the irritant applied. The term mixed-cell leukæmia is therefore no longer necessary. But the spleen, bone-marrow, and lymphatic glands have a close physiological connection, as Flexner proved by their universal reaction to lymphotoxic and myelotoxic serums, so that in all cases of leukæmia changes in all these tissues may be expected. Ehrlich regarded the subsidiary developments in these tissues as merely metastatic from the primary

marrow tumour-formation when myelocytes predominated, or a primary lymphatic tumour-formation when lymphocytes were in excess. It is true that clinically there is a likeness to new growth in that the marrow may invade and even deform the bone, but the subsidiary growths always occur in sites where "leucoblastic" tissue is normally present, so that the metastatic character cannot be admitted, and the condition should be regarded as one of hyperplasia of pre-existing elements. Theoretically a lymphocytic leukæmia might be possible from hyperplasia of adenoid tissue to the exclusion of the marrow, but no case has been reported; the question is, however, of great interest in connection with lymphadenoma.

The hyperplasia may be acute or chronic. Acute lymphatic leukæmia is a much commoner disease than the chronic variety. The former is a disease of adult life, while the latter occurs only in adults. Acute myelocytic leukæmia, on the other hand, is rare. Kelly* gives references to cases described by Ewing, Hirschfeld, Turk, Grawitz, and Billings and Capps.†

The various theories that have been advanced concerning the etiology of the disease may be reduced to two: (1) the parasitic, and (2) the toxic theory. Löwit§ has described an amœboid organism which he calls the *hæmamœba leucæmiæ magna*, and which he states can be demonstrated by special staining method in the blood and tissues of patients suffering from myelogenous leukæmia. A similar but smaller organism, the *hæmamœba leucæmiæ parva*, is to be found in the blood in lymphatic leukæmia. These organisms are said to form spores and to pass through stages very similar to those of the malarial organism. They have not been artificially cultivated. By injection of fresh leukæmic tissues into rabbits, Löwit claims to have produced the disease and to have found the hæmamœba in the diseased parts. These results, although three years old, have not yet been confirmed. Among other organisms which have been found in the blood, streptococci are the most numerous. In two cases of lymphatic

* "Univ. of Pennsylvania f. Med. Bull." Oct., 1903
† *Amer. Jour. Med. Sci.*, 1903, p. 375
§ "Centralbl. für Allge. Path., 1901, p. 913

leukæmia, I obtained a streptococcus from the blood during life, and from several of the organs after death. This organism grew well on blood-agar, producing white stellate colonies. Inoculation into rabbits produced no result. It is doubtful at present what relation such organisms have to the disease, and it is possible that they are only the result of a secondary infection.

The toxic theory does not necessarily exclude the parasitic theory, as any toxin present may be produced by organisms equally well as by a disordered metabolism. Flexner* found that experimental injection of a cytotoxine derived from bone-marrow was followed by a marked hyperplasia of lymphatic glands, intestinal lymphoid tissue, and spleen; and that lymphotoxine and splenotoxine produced a similar response, though less marked, in the marrow. He further showed that bone-marrow responded with an increase of mononuclear non-granular cells, and under the influence of myelotoxine with a production of granular mononuclear and polymorphonuclear cells. These experiments have a positive value, and show that the idea of irritative hyperplasia is not purely theoretical. Moorhead† ably sums up the arguments for the toxic theory, and records the results of his own experiments. He found that after precipitation with alcohol, a substance can be extracted from leukæmic lymph glands by saline solution which produces a marked fall of blood-pressure. This depressor substance is not a constituent of ordinary lymphoid tissue, and is possibly a specific toxin, because continuous injection of the extract containing it produced marked changes in the blood-forming tissues in rabbits.

The observation made by Heineke, that lymph glands became smaller and broke down under exposure to the Röntgen rays, encouraged their application in the treatment of leukæmia. Fried,†† McKerron,¶ Gordon,¶ Bozzolo,§ all

* "Univ. of Pennsylvania, f. Med. Bull." 1902, XV., p. 287
† *Brit. Med. Jour.* Sep. 10, 1904
†† "Münch. Med. Woch." Oct., 1904
¶ Aberdeen Medico Chir. Soc. Dec. 1, 1904
§ "Giornale della R. Acad. di Med. di Forino." July—Aug., 1904

record cases in which exposure to the rays has been followed by distinct improvement in the general condition, diminution in the size of the cells, and reduction in the number of leucocytes. It is too soon to know whether these results are permanent, and what is the rationale of the treatment.

W. H. WYNN.

THE RÔLE OF THE LYMPHOCYTE.

HISTORY repeats itself in the progress of science as well as in the story of the race. What was believed by one generation or decade is disproved by the next, only to be again strongly advocated by those who follow. The "humoral" theory of disease was displaced by the "cellular," only to be ousted in its turn by toxins and anti-toxins. But perhaps, after all, ousted is too strong a word. The pendulum swings to one side, then to the other, but it ultimately comes to rest just half-way between the extremities of the swing.

As the result of his experimental investigations on inflammation in 1874, Ziegler came to the conclusion that "of the white blood cells which wander out of the vessels in inflammation, the polynuclears are incapable of further development, while the mono-nuclear forms, the lymphocytes, undergo a further transformation, and are capable of forming connective tissue." The tendency has been to confirm the first proposition, but the latter was for long regarded as insufficiently supported by facts. Perhaps this may have been because that attention was for a time almost entirely directed to the polymorpho-nuclear leucocytes. This was natural as, in the majority of inflammatory conditions largely increased numbers of these were found in the blood, whereas the number of the lymphocytes remained almost stationary. Recent investigations have shown, however, that the rôle of the lymphocytes is an important one; indeed, the tendency is to confirm the second part of Ziegler's contention above quoted, and to ascribe to them the capacity for developing and forming permanent constituents of the tissues.

An evidence of this increased interest is the fact that "the rôle of the lymphocyte" formed one of the chief subjects of discussion at the Pathological Section of the recent British Medical Association meeting at Oxford. Papers were read by Gulland, Muir, Beattie, and others, and no better resumé of the present state of opinion on this question can be found anywhere than in these papers, which appear in the *British Medical Journal*, Vol. II., 1904.

Naturally, one of the first questions to arise is: What is a lymphocyte? What forms of cells are included under the term? A short time ago a full answer to this question would have been—the smallest non-granular or hyaline cell of the blood. Now, however, the tendency is to use the term generically and to include under it all the hyaline leucocytes—that is to say, the small lymphocyte, the large lymphocyte, the large mononuclear, and the transitional cell all belong to one type; they represent different stages in the evolution of this type, which may for convenience sake be called the lymphocyte. Certain objections to this view might be raised from a morphological standpoint. The large mononuclear and the transitional cell differ from the small and large lymphocyte, in that the nucleus is indented or horse-shoe shaped, and that the protoplasm is larger in amount and less basophil than the nucleus. With regard to the first point, Gulland insists that the shape or size of the nucleus is a matter of no importance in the case of leucocytes. If one remember the pale oval nucleus of the myelocyte and the dark twisted one of the polymorphonuclears, and that the one becomes transformed into the other, there is no difficulty in accepting the notion of a transformation from lymphocyte into large mononuclear. Not only does a transformation of myelocyte into polymorph occur, but the reverse process may be observed in the case of pus cells. In fact, as is emphasised by Gulland, the tendency is in all cells such as leucocytes for the nucleus to become excentric and indented as development progresses. With regard to the second point of difference, this, too, is simply the natural outcome of growth and development. As

the amount of cytoplasm increases the tendency is for the strands and nodes of the cytoplasmic reticulum to become more separate, thinner, and not so basophil. Gulland therefore concludes that the small and large lymphocyte, the large mononuclear, and the transitional all belong to the same series, and that they represent different stages in the development of a cell to which the term lymphocyte may be applied. In another series of leucocytes—the polymorph—the same cycle of changes occurs as in the lymphocyte series, but only the terminal form or the polymorpho-nucelar leucocyte itself is found in the blood under normal conditions. On the other hand, all the members of the lymphocyte series are found normally in the blood, although the terminal forms are the rarest.

An interesting point arising here is whether the different series pass into one another; whether, for example, a lymphocyte may become a polymorph. Some consider that this does occur, and Gulland was at one time among them; he now states that he is not so sure that the different series pass into one another, and certainly he does not believe that transitionals become polymorphs to any extent.

The second question to be answered is: Where do the lymphocytes take origin? Lymph glands, tonsils and adenoid tissue generally are obvious sources. This was long ago proved by the researches of Hemming, who demonstrated mitosis in the cells of the lymph gland follicles. The spleen is another certain source, but Gulland considers that, under normal conditions, it is not an important one. According to him, and contrary to Ehrlich's assertion, the bone-marrow is the chief source of the lymphocytes.

Another point which comes under the same heading is this: There are several pathological conditions in which there is a marked increase in the number of lymphocytes, either locally or generally: where does this increased formation of lymphocytes occur? Examples of a local increase are found in most of the chronic forms of inflammation—as tubercle, where one finds what is usually known as a small-cell infiltration. Now it has long

been recognised that there are many possible sources of origin of these small hyaline cells. Four chief ones may be mentioned: (1) the lymphocytes of the blood by active emigration; (2) the lymphocytes of the neighbouring lymph channels and lymph glands; (3) the endothelial cells of vessels and lymph spaces which detach themselves and become rounded; (4) connective tissue cells, either those already formed or their descendants. Source No. 1 has been proved by Councilman in his investigations on acute nephritis. The question of the active emigration of these cells will be discussed more fully later. Source No. 2 has been demonstrated by Beattie in his experimental researches on peritonitis. He has shown that active proliferation may be observed in the lymphoid tissue round the vessels of the omentum; that the newly-formed cells get into the lymph stream and pass by the perivascular lymphatics, subsequently emigrating to the spot where the bacilli are. The possibility of the third source has also been proved by Beattie, and is strongly supported by Muir. As regards the fourth source, it has long been held that connective tissue cells could leave their fixed position and migrate, and also that under irritation they were capable of dividing and giving rise to round cells endowed with great activity. Such cells are known variously as clasmatocytes (Ranvier), and polyblasts (Maximow). During the early stages of the inflammatory process it is possible to distinguish between these cells of connective tissue origin and the true lymphocytes; in the later stages, however, most observers, including Mechnikoff, Marchand and Beattie, agree that distinction becomes impossible. To such round cells which resemble lymphocytes, but whose origin is uncertain, Marchand has applied the term "leucocytoid" cells. There appears to be no special reason why a transformation of connective tissue cells into lymphocytes should not occur, especially as they have a common origin in the embryo. Such a transformation would be all the more probable were the converse process proved to take place, and this passage of lymphocyte into connective tissue cell is extremely probable.

There are, further, certain diseases in which there is a generalised increase in the number of lymphocytes either in the blood or in the tissues, or in both. Leaving out of account the lymphatic leukæmias and sarcomatous conditions, we have examples of such diseases in typhoid, small-pox, anthrax in the human subject, and some diseases due to animal parasites such as malaria and trypanosomiasis. In these there is either a relative or absolute lymphocytosis of the blood. In typhoid, Longgcope has shown that there are changes in the bone marrow of the nature of a morbid increase in the percentage of lymphoid cells. MacCallum considers that the lymphoid tissue generally also plays a part, that there is a substance produced by the typhoid bacillus which exerts a positive chemiotactic influence upon these lymphoid cells, and he appears to be distinctly inclined to the idea that the large hyaline cells found in the Peyer's patch in typhoid, and considered by Mallory to be endothelial in origin, are, at least partly, enlarged lymphocytes.

In small-pox, Ferguson has shown that there is an excessive production of cells of the lymphocyte and smaller hyaline class, which are found in large numbers in the blood and in the skin lesions. This increase is accompanied by a considerable activity in the lymphocyte-producing tissues throughout the body. The subcortical lymphoid follicles of the lymph glands appear to be chiefly concerned in the process, although the Malpighian bodies of the spleen assist. Apparently he does not consider the bone marrow to be an important source.

We see, therefore, that although the bone marrow, spleen, lymph glands and lymphoid tissue generally are, probably, the chief sources of the lymphocytes in pathological as well as in normal conditions, cells bearing all the characters of lymphocytes and indistinguishable from them, may arise from endothelial and fibrous tissue cells.

Having considered the nature and mode of origin of the lymphocyte, the next point of importance is its function. Like all other forms of leucocyte, the function

of the lymphocyte is protective. Gulland draws attention to the fact that the main depôts for their manufacture, apart from the bone marrow, are round the hollow tubes of the body, the alimentary and respiratory, which are occupied by non-virulent saprophytic organisms, and that, in all probability, the lymphocyte is specially adapted to keep these organisms in check. We have seen that they are specially called upon in certain diseases, such as typhoid and small-pox. Muir states that the defence by the hyaline cells is brought into operation with relative slowness compared with the polymorpho-nuclears; probably this is due to there not being the same arrangement for rapid entrance into the blood stream.

The question now arises: In what sense are these cells protective? Do they act as phagocytes? It has been shown by Councilman, Beattie and myself that the larger forms of lymphocyte undoubtedly act as phagocytes. Further, that the smaller forms, in inflammatory conditions rapidly enlarge and become phagocytic. Also that this phagocytic property is manifested not only towards bacteria, but also towards other cells of the body, and particularly the polymorpho-nuclear leucocytes. These latter are more active in more acute inflammation, but in the more chronic and in the later stages of the acute process it is upon the macrophages, as Mechnikoff calls them, that the brunt of the contest falls; and among the macrophages the larger lymphocytes form an important group. We may conclude, therefore, with Mechnikoff and Muir, that the smallest form of lymphocyte is not an actively phagocytic cell, but that it it is capable of developing into a cell which exhibits phagocytic properties in a marked degree. MacCallum regards the large hyaline cells so characteristically found in typhoid lesions, and which Mallory considered to be endothelial in origin, as derived in a similar manner from lymphocytes. These cells also exhibit a marked phagocytic property towards other cells and bacteria.

Another point of interest is whether or not the lymphocyte is capable of exhibiting amœboid movement. For

long this question was answered in the negative, and probably one may still say that under ordinary circumstances the smallest forms of lymphocyte do not show active movement. Many recent observers, among whom one may mention Wolff, Hirschfeld, Jolly and Maximow, have shown, however, that, under certain conditions, the lymphocyte is capable of active movement. MacCallum has, further, demonstrated cells of an undoubted lymphoid nature half way through the endothelial walls of small veins, the nucleus being constricted to a narrow thread or isthmus lying in a similar narrow neck of the protoplasm, one part of the cell being within, the other outside, the vessel.

The last point to be considered is the ultimate fate of these cells. Are they broken up and destroyed, or do they remain as rounded cells, or do they develop into something else, as fibrous tissue cells? As previously stated, this last was the fate which Ziegler originally ascribed to them. And, although one would be far from right in asserting that opinion had come round to that view again, there can be no doubt that there is a tendency to regard the mononuclear cells of the blood as capable of further development. We have seen that they enlarge and act as phagocytes towards other cells. I have shown that in the earliest stages of the tuberculous process they become branched, that the branches unite with one another, forming a network which apparently may become the network or part of the cell network of the giant cell follicle. Maximow regards it as probable that such cells develop into fibroblasts, and with him Beattie agrees. There is no doubt, and to this all observers agree, that it is extremely difficult to make dogmatic assertions as to the nature of any given mononuclear cell, especially in the later stages of inflammation, when the participation of the descendants of fibrous tissue cells cannot be excluded. At the same time, one may safely say that, although the question is not, and may never be, decided, the assertion that lymphocytes are capable of forming fibrous tissue cells is no longer regarded as absurd.

JAMES MILLER.

REPORTS OF SOCIETIES.

BRITISH MEDICAL ASSOCIATION.

BIRMINGHAM BRANCH.

ANNUAL MEETING, JUNE 8th, 1905.

The Fifty-first Annual General Meeting of the Branch was held at the Medical Institute, on June 8th, 1905. The Chair was taken at 4-0 by the retiring President, Dr. T. E. Underhill. There were 48 Members present.

The Hon. Sec. read the circular convening the Meeting.

The Minutes of the previous Annual General Meeting were read, confirmed, and signed.

Letters of apology were read for non-attendance from Dr. Herbert Manley, Mr. Barling, and Dr. Edginton.

The Reports of the Council, of the Representatives of the Branch in the Central Council, and of the Ethical Committee being taken as read, a discussion took place on the Financial Statement, in which Drs. Milner Moore, Shiels, William Thomas, Morrison, Thomas Wilson, and Jordan Lloyd took part. In the absence of the Hon. Treasurer, Mr. Marsh, the Hon. Secs. were unable to give the Meeting information on some of the points referred to.

It was proposed by Dr. Thomas, seconded by Dr. Moore, and resolved—

> "That in future the accumulated fund and expenditures from it appear as separate items in the Financial Statement."

A Report from the Pathological and Clinical Section was placed before the Meeting, as the Report presented was not approved by the Council.

The President then announced that the following elections were made to uncontested offices:—President-Elect, Dr. O. F. Wyer; Hon. Treasurer, Mr. F. Marsh; Hon. Secs., Drs. Short and Kauffmann; Representatives on the Council of the Association, Messrs. Langley Browne and Morrison.

It was proposed from the Chair, and resolved—

"That Dr. J. W. Russell be the Hon. Auditor, and Messrs. Charlton & Long the professional Auditors for the ensuing session."

It was proposed by Dr. Simon, seconded by Dr. McCardie, and resolved—

"That the best thanks of this Meeting be, and are hereby, accorded to Messrs. Langley Browne and Morrison, the Representatives of the Branch in the Central Council, for their services during the past year."

It was proposed by Dr. Stanley, seconded by Mr. Nuthall, and resolved—

"That the best thanks of this Meeting be, and are hereby, accorded to the Hon. Treasurer, Mr. F. Marsh, and the Hon. Auditor, Dr. J. W. Russell, for their services during the past year."

It was proposed by Dr. Plummer, seconded by Dr. Melson, and resolved—

"That the best thanks of this Meeting be, and are hereby, accorded to Drs. Short and Kauffmann, the Hon. Secs., for their services during the past year."

It was proposed by Mr. Morrison, seconded by Mr. Lucas, and resolved--

"That the best thanks of this Meeting be, and are hereby, accorded the Chairman and Hon. Secs. of the Pathological and Clinical Section, for their services during the past year."

The President then moved, on behalf of the Council, and it was agreed—

(1) That the following addition be made at the end of Rule 4, "If there be no contest, no voting papers will be sent round, and the elections will take place at the Annual Meeting."

(2) That in Rule 7, section (a), subdivision (2), last line, the word "week" be substituted for the word "month."

(3) That in Rule 10, the words in the last paragraph from "unless" to "voting," both inclusive, be omitted, and that the paragraph commence with the word "No."

(4) That in Rule 14, the word "may" be inserted between the words "and" and "levy" in the first sentence, second and third lines; and that the words "by the section" in the last sentence be replaced by the words "at the last sessional meeting of the section, after nomination at the preceding meeting."

It was proposed by Mr. Lucas and seconded by Mr. Wm. Thomas—

"That circulars of all Meetings of the Pathological and Clinical Section be sent to all members of the Birmingham Branch."

This was discussed by Mr. Nuthall, Dr. Saundby, Dr. Melson, Mr. Morrison, Dr. Short, Mr. Leedham Green, Thomas Wilson, Drs. Perry, Stanley, Simon, Plummer, and Mr. Marsh.

Dr. Milner Moore proposed an amendment, seconded by Dr. Shiels, but it was ruled out of order as being a direct negative.

When put to the vote Mr. Lucas's resolution was lost by 21 to 12.

The resolution down in Dr. Stanley's name, viz.—

"That the Pathological and Clinical Section cease to meet,"

was ruled out of order by the President, as being not in accordance with Rule 15, which was quoted.

It was proposed by Dr. Kirby, seconded, and resolved, as an amendment to Rule 6—

To delete the words "If a Membership of the Branch be fifty or less, such Division shall elect one Member of Council," and insert "If the Membership of a Division be one hundred or less such Division shall elect two members of Council, one of whom shall be the Hon. Sec."

Dr. T. E. Underhill then introduced his successor, Mr. T. F. Chavasse.

It was proposed by Dr. Thursfield, seconded by Mr. Haslam, and carried with acclamation—

"That a vote of thanks be accorded to the retiring President for his services during the past year."

The President, Mr. T. F. Chavasse, then delivered his Address.

It was proposed by Dr. Underhill, seconded by Dr. Oakes—

"That the best thanks of the Branch be accorded to the President, for his able and interesting Address."

This concluded the business.

KIDDERMINSTER MEDICAL SOCIETY.

A MEETING of this society was held at the Kidderminster Infirmary on Friday, 26th May, Mr. C. D. Fitch (president) in the chair.

Cases and Specimens.—Mr. J. Lionel Stretton showed :—

1. Two girls from whom he had removed large masses of tubercular glands in the neck. The first was 17 years of age, and the glands removed necessitated a free dissection of the anterior and posterior submaxillary triangle on the right side. This was accomplished through an incision running the whole length of the sterno-mastoid, and one at right angles to the tip of the chin. The glands removed weighed a pound and a quarter. The second was 19 years of age. There was a large mass in the neck, and at its centre a small scar where an attempt had been made to remove it six weeks previously in America. The growth was found to involve the right sterno-mastoid muscle, and it was necessary to remove the whole of this, together with the jugular vein, through one incision along the anterior border of the muscle. The report of the C.R.A. states : "This mass consists of chronic inflammatory granulation tissue, containing many quite typical miliary tubercles. There is practically nothing to be seen of the nature of lymphatic gland, but at one place the process has involved striated muscle fibres." The case is of particular interest, as it proves the implication of the muscle, which Mr. Stretton has several times before been obliged to remove whole or in part. This experience appears to be at variance with that of some surgeons. In a recent

paper in the *British Medical Journal* it is stated: "I have now operated on 25 of these necks, and have yet to find a case where it is necessary to even partially divide the sterno-mastoid." The girl has perfect movement, in spite of the loss of the muscle.

2. A female child, aged 3 years, from whom he had excised the wrist, for tubercular disease. The whole of the carpus and meta-carpus, together with the ends of the radius and ulna, were removed—portion of the bone shown. The wound healed by primary union, and there is a fair range of movement, which is increasing.

3. Notes of a case of anthrax successfully treated with Professor Sclavo's serum without excision of the pustule, the fifth case so treated in the kingdom, and the fourth successful.

4. An ovarian cyst, with twisted pedicle, removed from a woman aged 56.

5. A fibroid tumour of the uterus weighing 4lbs., and a cystic ovary removed from a woman aged 45.

6. A cystic prolapsed ovary removed from a woman aged 33.

7. A large ovarian cyst of the left side, together with a large solid tumour and cyst which involved the right broad ligament and cœcum. After removal it was found to consist of a cancerous growth originating in the cœcum. She never suffered from any symptoms until six weeks before operation.

Dr. Evans showed a man, aged 48 years, the greatest portion of whose right elbow joint he had removed nine years previously, for an injury to the joint. The ends of the radius and ulna had been taken away, the end of the humerus left. He had a very useful arm, and could carry on his work as a farm labourer.

Dr. Evans also read notes of a case of a woman, aged 36, upon whom he had performed the operations of Cæsarian section and hysterectomy. The operation was necessitated by a rupture, posteriorly, of the uterus complicating a hand presentation. The woman had previously had nine normal labours.

Mr. Dykes showed a case of "convulsive tic." When admitted the patient, a woman, suffered from severe spasmodic jerks of muscles of head and limbs; the movements ceased during sleep; under treatment with tonics there was great improvement.

He also showed a specimen of a mediastinal cancer. The growth surrounded the trachea and aorta, and involved both lungs. There were secondary growths in the liver. He also had notes of a case of aneurysm of the innonimate artery, which was being treated by needling, and had diminished in size.

Dr. Evans read a paper on "Some old remedies."

BOOKS RECEIVED.

From Young J. Pentland—

The Edinburgh Medical Journal, 1905. Vol. I.

From James MacLebese—

A Plea for the More General use of Tuberculin. By Prof. McCall Anderson.

From Baillière Tindall and Cox—

A Handbook of Intestinal Surgery. By Leonard Bidwell, F.R.C.S.

The Rôle of Modern Dietetics. By J. Sims Wallace, M.D.

From William Green and Sons, Edinburgh—

Methods of Morbid Histology. By Walker Hall, M.D., and G. Herxheimer, M.D.

From John Bale, Sons and Danielsson—

Notes on Clinical Blood Pressure Instruments. By E. Birt, M.D.

From H. K. Lewis—

The Child's Diet. By J. Sadler Curgenven, M.R.C.S.

From Cassell and Co.—

The Care and Management of Delicate Children. By Percy Lewis.

From Rivington's—

Health at School. By Clement Dukes, M.D.

From Rebman, Limited—

Health and Disease in Relation to Marriage. By Senator and Kaminer.

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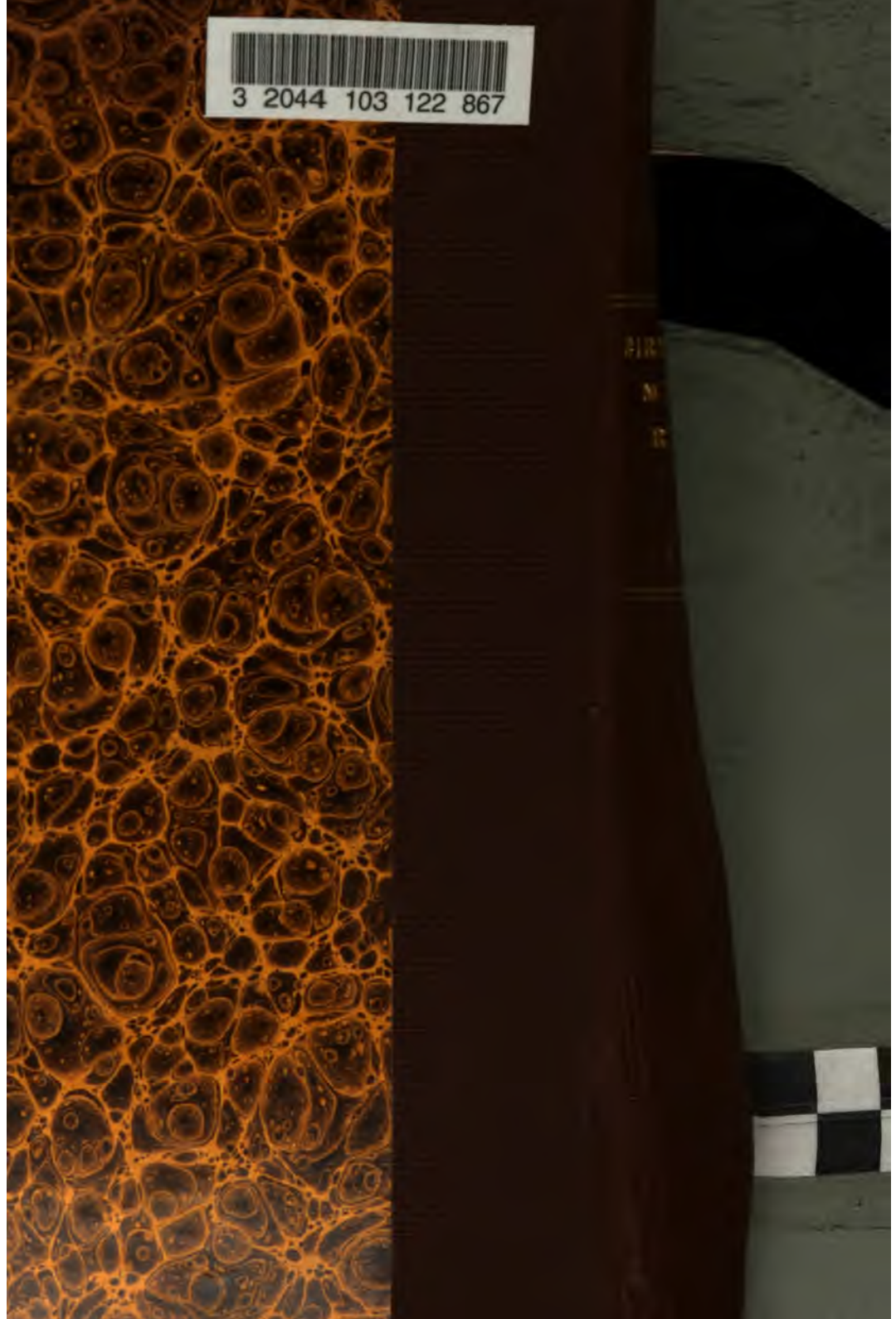
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